GREEN FORAGE CROPS AND CORN FOR FATTENING LAMBS

OHIO
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BULLETIN 340

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BULLETIN
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GREEN FORAGE CROPS AND CORN FOR FATTENING LAMBS

J. W. HAMMOND

INTRODUCTION

It has been a common practice in Ohio to pasture sheep on permanent pastures, consisting entirely or in part of bluegrass. There are sections of the State, however, in which permanent pastures are not abundant, and many farms in such localities could support flocks of sheep by the judicious use of a succession of annual pasture crops.

Notwithstanding the high value of bluegrass pasture, it has its limitations, also. When grazed by sheep year after year, as is the common practice in many sections of Ohio, permanent pastures are frequently the source of serious parasitic infestation. During midsummer and early autumn, particularly in dry seasons, bluegrass pastures are frequently dry and unpalatable. The combination of short, dry pastures and internal parasites at the time the lambs are weaned, one of the most critical periods in the life of a lamb, is one of the most common causes of unthrifty lambs. As a means of supplying green feed and perhaps of lessening the damage from parasitic infestation, annual forage crops may frequently be used to supplement permanent pastures on which lambs are grazed. One of the most easily grown and most productive successions of forage crops is rye, clover and rape. The first three experiments reported in this bulletin furnish a comparison of bluegrass with rape or with a succession of rye, clover and rape for raising and fattening lambs.

Another question of importance to sheep men, particularly during periods of high-priced grain, is, "How much, if any, grain can profitably be fed to lambs on pasture?" The experiments reported in this bulletin give some information which may help to answer this question.

Because of the many factors which vary from year to year, such as season, soil and thrift of the animals, it may readily be seen that definite conclusions can be based only on the results of numerous experiments covering a long period of time and a wide range of conditions. Further work along this line is in progress, and this bulletin is issued as a report of progress rather than as the final answer to the questions dealt with.

Experiments I, II and III were conducted at the Southeastern Test Farm at Carpenter. Much credit for assisting in planning and conducting them is due to the shepherd, E. C. Schwan. Experiment IV was conducted at the Experiment Station at Wooster.

EXPERIMENTS I AND II

Object.—These two experiments in raising and fattening lambs were conducted with the following objects in view:

1. To compare permanent bluegrass pasture with rape pasture or with a succession of the three annual pasture crops—rye, clover and rape.
2. To secure data on the economy of feeding corn on pasture.
3. To compare the economy of raising lambs on pasture and in dry lot.

Plan of experiment.—Experiment I lasted from June 14 to October 22, 1913, inclusive, a period of 131 days. Five lots of five lambs each were used in this experiment. Five lots of ten ewes and ten lambs each were used in Experiment II, which lasted from May 11 to October 10, 1916, inclusive, a period of 153 days. In this experiment the lambs were weaned on July 6, after which the ewes were removed from the experiment.

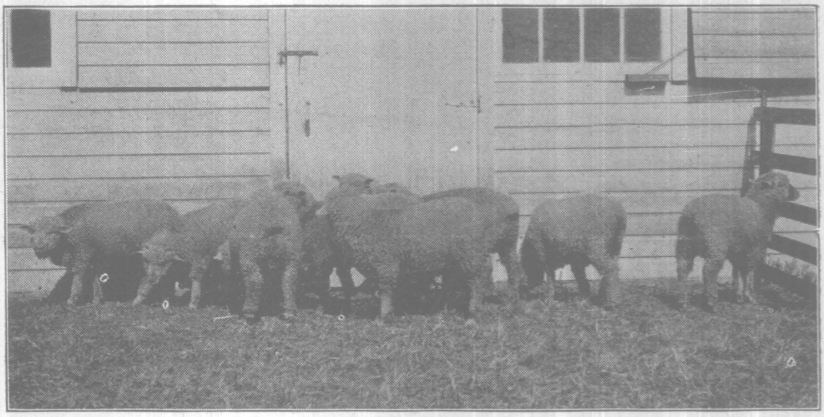
Sheep used.—The lambs used in Experiment I were from high grade Delaine Merino ewes, mostly of the C type, and were sired by purebred Southdown rams. They were born late in November and December, 1912, and early in January, 1913. They were weaned on May 3, and until the time the experiment began they were confined to the barn and to a dry lot. The ewes used in Experiment II were similar in every respect to those which raised the lambs used in Experiment I. The lambs used in Experiment II were also sired by purebred Southdown rams and were younger than those used in Experiment I. The illustrations on pages 47 and 48 show the appearance of the lambs used in Experiments I and II.

The ewes and lambs were divided so that the lots were as nearly uniform as possible.

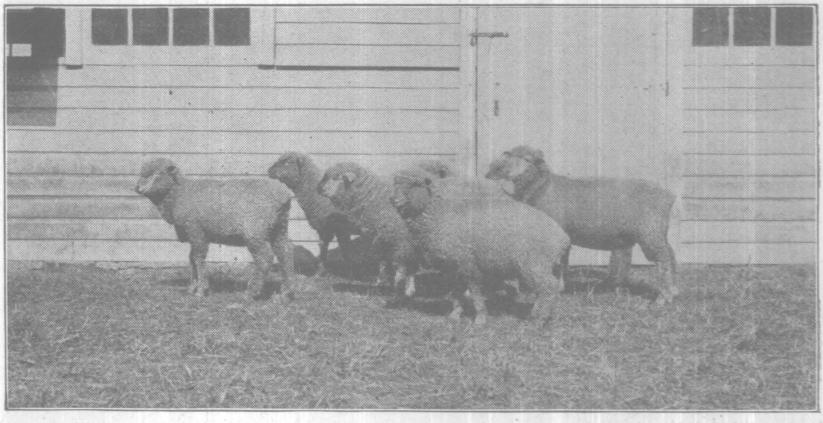
Lot 1. Southdown x Merino lambs in Experiment II. Corn and clover (dry lot)

Lot 2. Southdown x Merino lambs in Experiment II. Bluegrass pasture

Lot 3. Southdown x Merino lambs in Experiment II. Bluegrass pasture and corn



Lot 4. Southdown x Merino lambs in Experiment II. Rape pasture



Lot 5. Southdown x Merino lambs in Experiment II. Rape pasture and corn

Rations.—The rations fed were as follows:

EXPERIMENT I

Lot 1. Corn and alfalfa hay in dry lot.
Lot 2. Bluegrass pasture.
Lot 3. Bluegrass pasture and corn.
Lot 4. Rape pasture.
Lot 5. Rape pasture and corn.

EXPERIMENT II

Lot 1. Corn and clover hay in dry lot.
Lot 2. Bluegrass pasture.
Lot 3. Bluegrass pasture and corn.
Lot 4. Rye pasture, May 11 to May 18, inclusive.
Clover pasture, May 19 to July 5, inclusive.
Rape pasture, July 6 to October 10, inclusive.
Lot 5. Pasture same as Lot 4, and corn.

Table I shows the average amount of feed, aside from pasture, consumed daily per head by each lot which was fed grain, for 4-week periods.

TABLE I.—AVERAGE DAILY FEED, ASIDE FROM PASTURE, CONSUMED PER HEAD FOR 4-WEEK PERIODS

Experiment I

Period	Lot 1		Lot 3	Lot 5
	Corn	Alfalfa	Corn	Corn
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
June 14 to July 11	.73	1.19	.50	.50
July 12 to August 8	.96	1.16	.50	.50
August 9 to September 5	1.01	1.14	.57	.57
September 6 to October 3	1.02	1.19	.89	.89
October 4 to October 22*	1.00	1.31	1.00	1.00
June 14 to October 22	.94	1.19	.67	.67

Experiment II

Period	Lot 1				Lot 3	Lot 5
	Ewes		Lambs		Lambs	Lambs
	Corn	Clover	Corn	Clover	Corn	Corn
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
May 11 to June 7	.75	2.67	.25	.81	.24	.24
June 8 to July 5	.75	2.76	.25	1.25	.25	.25
July 6 to August 2	.....	.....	.27	1.43	.26	.26
August 3 to August 30	.....	.....	.87	1.34	.49	.49
August 31 to September 27	.....	.....	1 00	1.24	.74	.65
September 28 to October 10†	.....	.....	1.00	1.15	.75	.67
May 11 to October 10‡	.75	2.71	.57	1.21	.42	.40

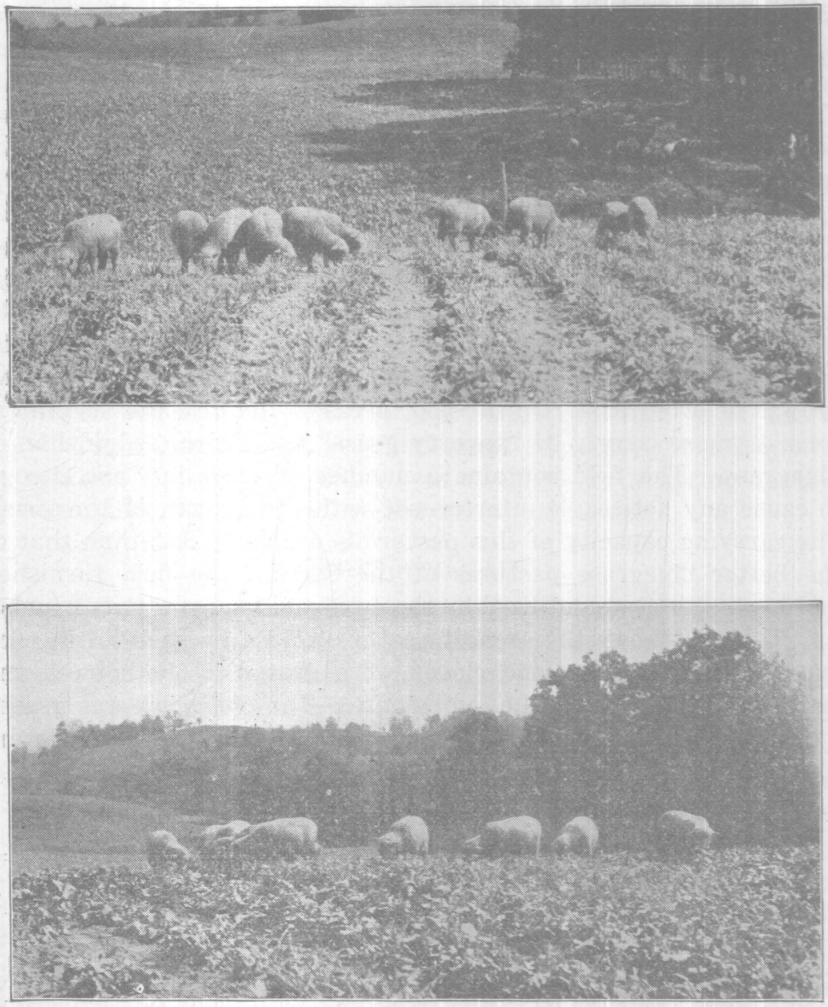
*19 days in this period.
†13 days in this period.
‡May 11 to July 5, inclusive, for the ewes.

The ewes in Lot 1, Experiment II, and the lambs in Lot 1 in both experiments were fed all the hay they would consume. In Experiment I, the lambs fed in dry lot were fed a heavier corn ration than was fed to the lambs on pasture, while in Experiment II it was

planned to feed all lots the same amount of corn. It was planned to feed the lambs a light corn ration at first and to increase the corn ration during the latter part of the experiments. In Experiment II it was impossible to get the lambs on pasture to eat a heavy ration of corn. This was particularly true of Lot 5, which went off feed during the last 6 weeks of the experiment. Since the lambs were fed during the summer months, they probably did not eat as much corn as they would have eaten in cooler weather. The latter part of the summer of 1916 was unusually hot, which may account for the low consumption of corn by the lambs used in Experiment II. No feed, aside from pasture, was given to any of the ewes except those in Lot 1.

Feeds used.—The shelled corn and the clover and alfalfa hay fed were all of good quality. The rye grazed by Lots 4 and 5 in Experiment II was seeded as a cover crop the preceding autumn, and supplied the lambs with pasture until May 19, when the clover was ready to use. The clover pastured by these two lots was seeded early in the spring of the preceding year. It consisted mainly of the medium red variety, with a slight mixture of alsike. The clover made a good growth and furnished an abundance of feed for the ewes and lambs until July 6, when the lambs were weaned and put onto rape pasture. The rape used was of the Dwarf Essex variety and was seeded as early in the spring as the weather would permit in ground that had been well manured and fertilized. The rape was seeded in drills 28 inches apart and was cultivated frequently until it was ready to pasture; an occasional cultivation was given while it was being pastured. The rape used in Experiment I made a fairly good growth, although somewhat retarded, particularly during the early part of the summer, by the ground being too wet. The rape used in Experiment II made a good growth. Three plots of rape were used in this experiment, the lambs being changed from one plot to another as the rape was eaten off, and changed back again after a new growth was well started. The illustrations on page 51 show something of the topography of the land upon which the rape was grown. Such land is not as well suited for experimental purposes as is land more nearly uniform in character.

Lots 2 and 3 in Experiment I grazed over a field of bluegrass containing 3 acres. The field was divided into two parts of approximately equal size and each lot of lambs was shifted from one part of the field to the other every 2 weeks to overcome some slight differences which probably existed in the quality of the pasture. The field grazed by these two lots had a fairly good bluegrass sod, which supplied a little more grass than was utilized by the lambs.



Lots 4 and 5, Experiment II, showing topography of the land used for growing rape used in the experiment

Lots 2 and 3 in Experiment II had access to a field of bluegrass containing 11.1 acres, divided into two parts of approximately equal size. Since it was impossible to make the two parts closely comparable with respect to uniformity of pasture, Lots 2 and 3 were shifted from one part of the field to the other every 2 weeks to overcome whatever inequalities may have existed. This pasture is rather typical of that found in many sections of southeastern Ohio. The land is rolling to hilly in topography and is traversed by numerous ravines, the most of which have steep banks. An idea of the topography of the land may be had from the illustrations of Lots 2, 3, 6 and 7 on pages 66 to 69. The photographs from which these illustrations were made were taken in the bluegrass pasture used in Experiment II. The soil is of a sandstone and shale formation, and in a few places has been gullied by erosion. Along the banks of the ravines the soil is shallow and in a low state of fertility, while on many of the higher areas the soil is fertile and supports a rank growth of bluegrass. On the poor areas of the field the vegetation consists more largely of "poverty grass" and broom sedge than of bluegrass. The field contains a number of trees but not enough to cause any noticeable interference with the growth of the grass. The carrying capacity of this pasture is decidedly less than that of the better bluegrass pastures of the State. The field furnished more grass than was utilized by the ewes and lambs in Lots 2 and 3.

Table II shows the area of pasture grazed by each lot in each experiment. The rye and clover were grazed by both ewes and lambs, and the rape by the lambs only. The bluegrass was grazed by both ewes and lambs in Experiment II until the lambs were weaned on July 6.

TABLE II—AREA OF PASTURE GRAZED BY EWES AND LAMBS

Experiment 1

Pasture	Lot 2	Lot 3	Lot 4	Lot 5
	Acres	*Acres*	*Acres*	*Acres*
Bluegrass	1.5	1.5		
Rape			.306	.316

Experiment II

Pasture	Lot 2	Lot 3	Lot 4	Lot 5
	Acres	*Acres*	*Acres*	*Acres*
Bluegrass	5.55	5.55		
Rye			1.125	1.125
Clover			.48	.48
Rape*			1.12	1.09

*Approximately one-half acre for each lot was not pastured until September 21, and about half of this amount was not fully utilized when the experiment closed, so the lambs should not be charged for the use of this amount of land for the entire season.

Method of feeding and handling.—Lot 1 in both experiments was confined to a pen 12 by 20 feet in a feeding shed and to an outside dry lot of about the same size. The daily ration was given in two equal parts, morning and evening. The other four lots were kept on their respective pastures at all times except when they were driven to the barn to be weighed or to be treated for internal parasites. Until they were weaned, the lambs that were fed corn were fed behind "creeps" which excluded the ewes. Corn was fed to Lots 3 and 5 in the evening in Experiment I, while it was fed in the morning to the corresponding lots in Experiment II. Lots 2, 3, 4 and 5 in Experiment I and Lots 4 and 5 in Experiment II were provided with sheds to furnish shade. Trees furnished shade for Lots 2 and 3 in Experiment II.

All the lambs except those in Lot 1 were given the blue vitriol treatment for stomach worms and tape worms on June 14 in Experiment I, and on July 22 and again on September 4 in Experiment II.

Water and salt.—Water was kept before the lambs at all times in galvanized iron troughs or pails except in case of Lots 2 and 3, Experiment II, to which water was supplied by a spring in the pasture. Salt was kept before the lambs at all times.

WEIGHTS AND GAINS

In Experiment I the initial and final weights were secured by averaging three weights taken on successive days. It was planned to follow the same method in Experiment II. The ewes and lambs were weighed on April 19, 20 and 21, but by the time the initial weights were taken the weather turned so cold and rainy that it was not advisable to turn the sheep out to pasture until April 30, and a single weight taken on May 11 after the ewes and lambs were accustomed to the pasture was used as the initial weight in this experiment. The weight of the ewes and lambs at weaning time and the final weight of the lambs was secured by averaging three weights, taken on successive days. In both experiments the sheep were weighed every 2 weeks. All weights were taken shortly after noon after the sheep had access to their usual feed and water. Table III shows the initial and final weights and the gains made. In Experiment II, the gains made both before and after weaning are shown.

The lambs used were small at the beginning of the experiments and they were fed for the most part during the hot summer months, consequently they did not make as large gains as are expected from larger lambs or from lambs fattened during the winter.

TABLE III.—WEIGHTS AND GAINS

Experiment I. Five lambs in each lot; test lasted 131 days, June 14 to October 22, 1913, inclusive

	Lot 1 Corn and alfalfa Dry lot	Lot 2 Bluegrass	Lot 3 Bluegrass and corn	Lot 4 Rape	Lot 5 Rape and corn
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Initial wt., June 12, 13, 14	243.5	243.5	238.5	240.5	245.5
Final wt., Oct. 22, 23, 24	411.5	315.5	355.	314.5	363.5
Total gain	168.	72.	116.5	74.	118.
Av. daily gain per head	.256	.110	.178	.113	.180

Experiment II. Ten ewes and ten lambs in each lot;* test lasted 153 days, May 11 to October 10, 1916, inclusive

Ewes and lambs before weaning, May 11 to July 5, inclusive

	Lot 1 Corn and clover Dry lot		Lot 2 Bluegrass		Lot 3 Bluegrass and corn		Lot 4 Rye and clover		Lot 5 Rye, clover and corn	
	Ewes	Lambs	Ewes	Lambs	Ewes	Lambs	Ewes	Lambs	Ewes	Lambs
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Initial wt., May 11	820	315	795	330	750	325	790	340	785	350
Wt. July 4, 5, 6	785	481.5	788.5	521.5	773.5	521.5	756.5	482.5	718.5	503.5
Total gain	—35	166.5	—6.5	181.5	23.5	196.5	—33.5	142.5	—66.5	153.5
Av. daily gain per head	.....	.297	.....	.324	.....	.351	.....	.254	.....	.274

Lambs after weaning, July 6 to October 10, inclusive

	Lot 1 Corn and clover Dry lot	Lot 2 Bluegrass	Lot 3 Bluegrass and corn	Lot 4 Rape	Lot 5 Rape and corn
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Final weight, Oct. 10, 11, 12	725	623.5	*593.5	691.5	746
Total gain	243.5	112	122	209	242.5
Av. daily gain per head	.251	.115	.131	.215	.250

Lambs during entire experiment, May 11 to October 10, inclusive

	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs*
Total gain	410	293.5	318.5	351.5	396.0
Av. daily gain per head	.268	.192	.214	.230	.259

*One lamb in Lot 3 died August 30; weight 50 pounds.

COST OF GAINS

Table IV shows the cost of the feed consumed per 100 pounds of gain produced by the different lots with corn, hay and pasture at figures covering a wide range in price. Owing to the fact that the ewes and lambs in Experiment II were on rye and clover for only a short time, and because of the difficulty of assigning even an approximate value to these pastures, Table IV

deals only with the period of Experiment II which elapsed after the lambs were weaned, and when the lambs in Lots 4 and 5 were pastured solely on rape. Because of the impossibility of securing exact data regarding the cost of bluegrass and rape pastures, arbitrary values have been chosen, ranging from $5 to $15 per acre for the former and from $10 to $30 per acre for the latter. These assumed charges are for the entire grazing season of 7 months. Lots 2 and 3 in the experiments reported in Table IV were not charged for the use of the bluegrass for the full grazing season, but only for the time covered by the comparison shown in the table.

TABLE IV.—COST OF FEED PER HUNDRED POUNDS OF GAIN

Experiment I. 131 days, June 14 to October 22, inclusive					
Feed price combination‡	Lot 1 Corn & alfalfa Dry lot	Lot 2 *Bluegrass	Lot 3 *Bluegrass and corn	Lot 4 Rape	Lot 5 Rape and corn
1	$6.13	$5.96	$7.45	$4.14	$6.40
2	9.19	8.94	11.18	6.20	9.60
3	12.25	11.90	14.88	8.27	12.80
4	18.38	17.85	22.35	12.40	19.20

Experiment II. After lambs were weaned; 97 days, July 6 to October 10, inclusive					
Feed price combination‡	Lot 1 Corn & alfalfa Dry lot	Lot 2 †Bluegrass	Lot 3 †Bluegrass and corn	Lot 4 Rape	Lot 5 Rape and corn
1	$6.40	$10.60	$13.11	$5.36	$6 47
2	8.93	15.91	20.57	8.04	9.70
3	11.90	21.26	27.42	10.72	12.94
4	17.85	31.86	41.13	16.08	19.41

*Bluegrass charged for 4 months, or four-sevenths of total price for the season.
†Bluegrass charged for 3 months, or three-sevenths of total price for the season.
‡Feed price combinations are as follows:

Combination	Corn, per bu.	Hay, per ton	Bluegrass, per acre	Rape, per acre
1	$ .56	$10 00	$ 5.00	$10.00
2	.84	15.00	7.50	15.00
3	1.12	20.00	10.00	20.00
4	1.68	30.00	15.00	30.00

Table IV shows a considerable variation in the cost of the gains made in the 2 years. This difference in cost is doubtless due to differences in the thrift of the lambs, and differences in the extent to which the lambs utilized the pastures.

By comparing the cost of gains produced by Lots 2 and 4, where bluegrass and rape were fed without corn, it may be seen that the cost was approximately the same for the two lots when an acre of rape was valued at from three to four times the value of an acre of bluegrass. A more useful basis for comparing the two kinds of pasture is the amount of gain produced by an acre of each pasture. (See Table VII.)

The fattening of lambs in dry lot in the summer is not a common practice in Ohio, but Table IV indicates that when grain and hay are cheap and when pasture is scarce or high in price, such a practice may be profitable.

Table IV shows that with all the given combinations of prices, the feeding of corn to lambs on either bluegrass or rape pasture resulted in more expensive gains. Table IV, however, makes possible only a limited number of comparisons at price combinations which are not likely to be exactly duplicated, and it fails to take into consideration all the factors which determine the economy of feeding corn on pasture. In Table IV no consideration is given to the fact that the lambs that were fed corn not only made larger gains than did the lambs fed on pasture alone, but that they were worth more per 100 pounds at the close of the experiment (see Table IX). A better basis for determining the economy of feeding corn on pasture is furnished by Table V, which shows the amount of corn fed, the amount of additional gain produced by feeding corn, and in case of Experiment II, shows the additional home value per 100 pounds of the corn-fed lambs, the additional home value of each lot resulting from feeding corn, and the net cost of the corn consumed for each 100 pounds of additional gain, after deducting the additional home value of the corn-fed lambs from the value of the corn consumed, with corn valued at $0.56, $1.12 and $1.68 per bushel. Since the lambs in Experiment I were not sold at the close of the experiment and there was no way of determining the relative values of the different lots, Table V does not show the net cost of the additional gains from feeding corn in Experiment I.

TABLE V, EXPERIMENTS I AND II.—NET COST OF CORN CONSUMED PER 100 POUNDS OF ADDITIONAL GAIN RESULTING FROM FEEDING CORN

	Experiment I		Experiment II	
	Lot 3 Bluegrass	Lot 5 Rape	Lot 3 Bluegrass	Lot 5 Rye, clover and rape
Additional gain due to feeding corn.....Pounds..	44.5	44	25	44.5
Corn consumed .....Pounds..	439.25	439.25	622	619
Additional home value, per 100 lbs., of corn-fed lambs.....Dollars..	.....	....	.69	.73
Additional home value, per lot, of corn-fed lambs* .....Dollars..	.....	.....	4.46	5.40
Net cost of corn consumed per 100 lbs. additional gain:†				
Corn at $0.56 per bu..... .....Dollars..	9.87	9.98	7.04	1.78
Corn at $1.12 per bu.....Dollars..	19.74	19.97	31.92	15.69
Corn at $1.68 per bu.....Dollars..	29.61	29.95	56.80	29.60

*This item represents the increase in value of the initial weight of the lambs and the additional value of the gain which resulted from feeding corn. In making this calculation the same initial weight was assumed for both lots on the same kind of pasture; otherwise the lots with the greater initial weight would have an undue advantage.

†Does not show net cost for Experiment I. See text immediately preceding table.

There are a few slight but unavoidable errors in the method of calculating Table V. No attention has been given to the fact that the corn-fed lambs probably consumed less green feed than did the lambs on pasture alone. Owing to the manner in which the market and home values of the lambs were computed (see p. 62) there was probably a greater difference in the home values than is shown in Table V. Because of these two unavoidable errors the net cost of the additional gains resulting from feeding corn in Experiment II was probably somewhat less than is shown in Table V.

Making allowance for the fact that the corn-fed lambs in Experiment I have not been credited with the slight increase in value due to feeding corn, Table V indicates that with corn at $0.56 per bushel, the net cost of the additional gains is likely to be less than prices for lambs which usually accompany that price for corn. The table also indicates that when corn is worth $1.12 or more per bushel, it is doubtful if it can be fed at a profit to lambs on bluegrass or on rye, clover and rape pasture. It should be kept in mind, however, that these data are based on relatively low prices for lambs (see Table IX). Corn at $1.12 to $1.68 per bushel is usually accompanied by much higher prices for lambs, and as higher prices are usually accompanied by a greater spread in price between good and poor lambs than is shown in Table V, the net cost of the additional gains from feeding corn at these prices would be lower than is shown in this table. With lambs selling at a much higher price it is possible that the corn-fed lambs would have commanded a sufficient premium to have paid for the corn at $1.68, or even more, per bushel.

DAILY RETURN PER LAMB FROM PASTURE

Table VI shows the value of the daily return per lamb with lambs at $10 and $15 per 100 pounds and at the actual home value per 100 pounds in Experiment II. (See p. 62 for home values and the method in which they were calculated.) In calculating this table the value of the corn at $0.56 and at $1.12 a bushel was deducted from the value of the returns yielded by the lots which were fed corn. No account was taken of the value of the gain or loss made by the ewes. In case of the lots fed corn, the profit or loss from feeding corn is included in the value of the daily return per lamb because of the impossibility of separating these two items.

A comparison of Lots 2 and 4 and of Lots 3 and 5 in Experiment I (Table VI) shows that in this experiment the value of the daily return per lamb was practically the same from bluegrass and from

rape pastures, alone or with corn, assuming that the value of the lambs in all lots was the same per 100 pounds at the close of the experiment. A study of the corresponding lots in Experiment II shows that the value of the daily return per lamb was considerably greater on rye, clover and rape than on bluegrass pasture, either on pasture alone or when corn was fed. The only cases in which the value of the daily return per lamb was increased by feeding corn, after deducting the value of the corn fed, was on both bluegrass and rape, with lambs at $15 per 100 pounds and corn at $0.56 per bushel, in Experiment I, and on rape in Experiment II with lambs at $15 per 100 pounds and corn at $0.56 per bushel.

TABLE VI.— DAILY RETURN PER LAMB FROM PASTURE

Experiment I

Price for lambs per 100 pounds	Lot 2 Bluegrass	Lot 3 Bluegrass and corn Corn, per bushel		Lot 4 Rape	Lot 5 Rape and corn Corn, per bushel	
		$.56	$1.12		$.56	$1.12
$10	$.011	$.011	$.004	$.011	$.011	$.005
$15	.016	.020	.013	.017	.020	.013

Experiment II

Price for lambs per 100 pounds	Lot 2 Bluegrass	Lot 3 Bluegrass and corn Corn, per bushel		Lot 4 Rye, clover and rape	Lot 5 Rye, clover, rape and corn Corn, per bushel	
		$.56	$1.12		$.56	$1.12
$10	$.019	$.017	$.013	$.023	$.022	$.018
$15	.029	.028	.024	.034	.035	.031
Home values*	.014	.012	.008	.018	.018	.014

*Home values were as follows (see p. 62): Lot 2, $7.05; Lot 3, $7.74; Lot 4, $7.71; Lot 5, $8.44.

GAIN PER ACRE FROM DIFFERENT KINDS OF PASTURE

Table VII shows the amount of gain per acre from the different kinds of pasture used and the value of such gains with lambs valued at $10 and $15 per 100 pounds, and at the home values as determined on page 62. In calculating this table, the gain or loss made by the ewes in each lot was valued at 6 cents per pound. At the prices received for the lambs, this valuation for the gain or loss by the ewes is too high but is about right for the assumed prices for lambs. In case of the corn-fed lots the value of the corn, at $1.12 per bushel, was deducted from the value of the gains made by the lambs. In such lots the profit or loss from the corn has all

been credited to the pasture. For this reason Table VII probably does not show the exact value of the gains per acre from pasture in case of the lots that were fed corn.

TABLE VII.—GAINS MADE ON DIFFERENT KINDS OF PASTURE

Experiment II: Rye and clover

	Gain on rye, 8 days, May 11-18, inclusive		Gain on clover, 48 days, May 19 to July 5, inclusive	
	Lot 4 Rye	Lot 5 Rye and corn	Lot 4 Clover	Lot 5 Clover and corn
Ewes on pasture....Number..	10	10	10	10
Lambs on pasture....Number..	10	10	10	10
Area of pasture grazed....Acres..	1.125	1.125	.48	.48
Gain or loss, per acre, on ewes....Pounds..	—26.67	—17.78	—7.29	—96.87
Gain, per acre, on lambs....Pounds..	17.78	22.22	255.21	267.71
Average daily gain on lambs....Pound..	.25	.313	.255	.268
Value of gain, per acre, on lambs:*				
Lambs at $10 per 100 pounds....Dollars..	.18	.85	25.08	15.96
Lambs at $15 per 100 pounds....Dollars..	1.07	1.96	37.84	29.34
Lambs at home values§....Dollars..	—.23	.51	19.24	11.78

Experiments I and II: Rape

	Experiment I 131 days, June 14 to October 22, inclusive		Experiment II 97 days, July 6 to October 10, inclusive	
	Lot 4 Rape	Lot 5 Rape and corn	Lot 4 Rape	Lot 5 Rape and corn
Lambs on pasture....Number..	5.	5.	10.	10.
Area of pasture grazed....Acres..	.306	.316	1.12†	1.09†
Gain, per acre, on lambs....Pounds..	241.83	373.42	186.6	222.93
Average daily gain on lambs....Pound..	.113	.180	.215	.251
Value of gain, per acre, on lambs:*				
Lambs at $10 per 100 pounds....Dollars..	24.18	9.54	18.66	13.45
Lambs at $15 per 100 pounds....Dollars .	36.27	28.21	27.99	24.59
Lambs at home values§....Dollars..	.....	.....	14.39	11.07

Experiments I and II: Bluegrass

	Experiment I 131 days, June 14 to October 22, inclusive		Experiment II 153 days, May 11 to October 10, inclusive	
	Lot 2 Bluegrass	Lot 3 Bluegrass and corn	Lot 2 Bluegrass	Lot 3 Bluegrass and corn
Ewes on pasture....Number..	.....	.....	10.	10.
Lambs on pasture....Number..	5.	5.	10.	10.‡
Area of pasture grazed....Acres..	1.5	1.5	5.55	5.55
Gain or loss, per acre, on ewes....Pounds .	.....	.....	—1.17	4.23
Gain, per acre, on lambs....Pounds..	48.	77.67	52.88	57.39
Average daily gain on lambs....Pound..	.110	.178	.192	.214
Value of gain, per acre, on lambs:*				
Lambs at $10 per 100 pounds....Dollars	4.80	1.91	5.22	3.75
Lambs at $15 per 100 pounds....Dollars..	7.20	5.79	7.86	6.62
Lambs at home values§....Dollars..	....	.....	3.66	2.45

*Where ewes were pastured with the lambs, the gain or loss by the ewes was valued at 6 cents per pound. The value of the corn (at $1.12 per bushel) fed to Lots 3 and 5 was deducted from the value of the gains made by these lots.

†In 3 plots; last plot pastured was not all eaten.

‡One lamb weighing 50 pounds died August 30.

§Home values in Experiment II were as follows (see p. 62): Lot 2, $7.05 per 100 pounds; Lot 3, $7.74 per 100 pounds; Lot 4, $7.71 per 100 pounds; Lot 5, $8.44 per 100 pounds.

The returns per acre from rye were small, but since the data shown in Table VII cover a period of only 8 days, these figures show but a small part of the returns which may be secured by pasturing rye. Further data on this point are reported in connection with Experiment III, p. 77. The data reported in Table VII also fail to show the entire value of the returns which may be secured from pasturing clover. After the lambs were taken off the pasture, the clover made a good growth and furnished an abundance of pasture for other lambs later in the summer and autumn. These data, together with those presented in Table XVIII, p. 78, indicate that this may be a profitable way to handle the clover crop, particularly since but little labor is required by this method.

Table VII shows that an acre of rape produced about five times as much gain in Experiment I and from three and one-half to four times as much in Experiment II as did an acre of bluegrass. Because of the better finish produced on rape in Experiment II, the value of the returns, based on the home values of the lambs, was still greater in favor of rape. Table VII does not show as large returns from rape as are to be expected under more favorable conditions. Because of drouth in the late summer the original plots of rape did not furnish enough feed to last throughout the experiment, and two other plots for each lot of lambs were used. The rape from the last plots used was not all eaten when the experiment closed. In calculating the gains from rape, the total area grazed was included as though it had all been used for the entire grazing season.

The gains per acre from bluegrass pasture shown in Table VII are smaller than are to be expected from pastures in the best bluegrass regions. Had there been enough lambs in the experiment to consume all the grass that was produced on the plots, the returns per acre would doubtless have been greater. Even the smallest return per acre ($3.66 from Lot 2, Experiment II) shown in Table VII was probably sufficient to pay 6 percent interest on the value of the land and to pay for the labor involved in caring for the lambs.

REPLACEMENT VALUE PER ACRE OF BLUEGRASS AND RAPE PASTURE

Table VIII shows the value of an acre of bluegrass and of rape in replacing corn and clover or alfalfa hay fed in the dry lot (Lot 1), with corn and hay at different prices. This table is calculated on the assumption that the gains produced by all lots were of equal

value. In Experiment I there was not much difference in the finish produced by the different rations, but in Experiment II, the lambs on pasture, and particularly those fed on bluegrass pasture, produced a less satisfactory finish than did those fed in the dry lot. This is shown by the yield of dressed carcass and by the prices shown on p. 63. If it were possible to take into consideration this difference in value of the finish produced, the replacement value of the different pastures, particularly in Experiment II, would be somewhat less than is shown in Table VIII.

TABLE VIII.—REPLACEMENT VALUE PER ACRE OF BLUEGRASS AND RAPE PASTURES

Experiment I: 131 days, June 14 to October 22, inclusive

Prices for feeds		Lot 1 Corn and alfalfa Dry lot		Lot 2 Bluegrass pasture		Lot 4 Rape pasture	
Corn, per bushel	Alfalfa, per ton	Total cost of production	Cost of production per cwt.	Total cost of production*	Replacement value per acre	Total cost of production*	Replacement value per acre
$ .56	$10	$10.29	$ 6.13	$ 4.41	**$2.94**	$ 4.53	**$14.80**
.84	15	15.44	9.19	6.62	**4.41**	6.80	**22.22**
1.12	20	20.58	12.25	8.82	**5.88**	9.06	**29.61**
1.68	30	30.88	18.38	13 23	**8.82**	13.60	**44.44**

Experiment II: 97 days, July 6 to October 10, inclusive†

Prices for feeds		Lot 1 Corn and clover Dry lot		Lot 2 Bluegrass pasture		Lot 4 Rape pasture	
Corn, per bushel	Clover, per ton	Total cost of production	Cost of production per cwt.	Total cost of production*	Replacement value per acre	Total cost of production*	Replacement value per acre
$ .56	$10	$14.49	$5.95	$6.66	**$1.20**	$12.44	**$11.10**
.84	15	21.73	8.92	9.99	**1.80**	18.64	**16.65**
1.12	20	28.98	11.90	13.33	**2.40**	24.87	**22.21**
1.68	30	43.47	17.85	19.99	**3.00**	37.31	**33.31**

*Based on cost of gain produced in dry lot (Lot 1).
†Includes only the time after the lambs were weaned. Before weaning the lambs were not on rape pasture.

Table VIII shows that in Experiment I, bluegrass pasture had a replacement value of $2.94 per acre with corn worth $0.56 per bushel and hay worth $10 per ton, the replacement value increasing, with increasing prices of feeds, up to $8.82 per acre with corn worth $1.68 per bushel and hay worth $30 per ton. In Experiment II the replacement value of bluegrass pasture was materially lower, owing to the land and pasture being poorer than that used in Experiment I, and possibly to the fact that not all the grass was utilized in Experiment II. Differences in season, in the nature of the land and in the thrift of the lambs will probably account for the difference in replacement value of rape in the two experiments. Another fact which may account for the lower replacement value of rape in

Experiment II is that after the lambs had eaten all the rape that was allotted them for the season, two small additional plots were made use of, so that not all of the land was utilized for the entire season.

MARKET FINISH AND PRICE, COST OF MARKETING AND HOME VALUES

In Experiment I, a slightly better finish was produced by corn and alfalfa hay in dry lot than was produced by pasture or pasture and corn. The lambs fed on rape pasture were in slightly better condition at the close of the experiment than were those fed on bluegrass pasture. The lambs fed corn in addition to pasture carried a slightly better finish than did those fed on pasture alone. Since there were too few lambs in the experiment to ship economically they were not sold until the following spring, and it was impossible to get a measure of their condition either by the market price or by a slaughter test.

The lambs in Lot 1, Experiment II, carried a prime finish at the close of the experiment. Lots 4 and 5, fed on rye, clover and rape, carried slightly less flesh than did Lot 1, fed in the dry lot, but more than Lots 2 and 3, fed on bluegrass. The two lots fed corn in addition to pasture carried a better finish than did the lots fed on pasture alone. At the close of the experiment there was a striking difference in the appearance of the lambs fed in dry lot and of those fed on pasture. The lambs fed in dry lot had a plump, finished appearance, while those on pasture, and particularly those on bluegrass, were more rangy in conformation and appeared to have developed frame rather than to have fattened.

The lambs used in Experiment II were shipped to Cleveland, Ohio, and were sold along with some other similar lambs. Upon arrival at market the lambs were divided into two lots and sold, one lot selling for $10.25 per 100 pounds and the other lot for $8 per 100 pounds. Since no record was kept of the number and weight of the lambs in each experimental lot that sold for each of the two prices, it is impossible to calculate the actual selling price of each lot in the experiment. An approximation of the market value of the different lots may be calculated from the market value and the yield of dressed carcass from Lot 1, and the yield of dressed carcass from the other lots. The lambs in Lot 1 were all included in the group that sold for $10.25 per 100 pounds and the average yield of dressed carcass from the lambs in Lot 1 was 53.5 percent. On the basis of a value of $10.25 per 100 pounds for Lot 1 and the carcass

yields for the different lots as shown by the slaughter test (see Table X), the prices for each lot would have been as is shown in Table IX. This calculation is based on the unjustified assumption that the dressed carcasses from the poorer lots were worth as much per pound as those from the better lots. For this reason Table IX makes the best lots appear to be worth less, and the poorest lots worth more, than they really were.

TABLE IX.—EXPERIMENT II. MARKET AND HOME PRICES AND COST OF MARKETING

	Lot 1 Corn and clover Dry lot	Lot 2 Bluegrass	Lot 3 Bluegrass and corn	Lot 4 Rape	Lot 5 Rape and corn
Market value, per 100 lbs.*	$10.25	$8.85	$9.47	$9.48	$10.12
Cost of marketing, per lot	5.03	4.11	4.12	4.84	5.17
Home value, per 100 lbs.	8.50	7 05	7.74	7.71	8.44

*Estimated, see p. 62.

The lambs were consigned direct to a packing firm so there were no charges for yardage and commission. The charges for freight and for feed enroute amounted to $0.75 per 100 pounds, based on the weight of the lambs in Cleveland. Since the weight of the lambs in the car was but 5,450 pounds, the cost of marketing was much higher than it would have been had there been enough lambs to bring the weight up to the minimum allowed on a car. Table IX shows the cost of marketing and the estimated market price and home value of each lot. The home values were calculated from the market prices as previously estimated (p. 62), after deducting the cost of marketing and making allowance for the shrink in shipping. The unusually heavy shrink in shipping and the additional cost of marketing a small lot resulted in a somewhat abnormally large margin between home and market prices.

SLAUGHTER TEST AND SHRINK IN SHIPPING

The lambs used in Experiment I were not sold until the following spring, and no slaughter test was secured. The lambs used in Experiment II were shipped to Cleveland, Ohio, on October 23, thirteen days after the close of the experiment. They did not arrive in Cleveland until about noon on October 25 and immediately after their arrival they were weighed and slaughtered without having access to feed or water, which will account for the rather unusually heavy shrink in shipping shown in Table X. This table shows that the lambs that were fed corn in addition to pasture shrank less in

shipping than did the lambs that were fed pasture alone. The lambs fed in dry lot (Lot 1) shrank less than did those fed on pasture, with the exception of those in Lot 5.

Table X shows that the lambs fed in dry lot (Lot 1) yielded the largest proportion of dressed carcass to live weight. The yield of dressed carcass was larger for the lambs fed on rape than for those fed on bluegrass, and was larger for those fed corn in addition to pasture than for those fed pasture alone. For the last 5 days before the lambs were shipped, after the experiment had closed, the lots on pasture were fed a small amount of corn and hay. This possibly would have a tendency to minimize differences in shrink in shipping and in the yield of dressed carcass.

TABLE X.—EXPERIMENT II. SLAUGHTER TEST AND SHRINK IN SHIPPING

	Lot 1 Corn and clover Dry lot	Lot 2 Bluegrass	Lot 3 Bluegrass and corn	Lot 4 Rye, clover and rape	Lot 5 Rye, clover, rape and corn
Home weight, October 23....Pounds..	750.	630.	620.	730.	765.
Cleveland weight, Oct. 25*..Pounds..	671.	548.	550.	645.	689.
Shrink in shipping.....Percent..	10.53	13.02	11.29	11.64	9.93
Yield of dressed carcass†....Percent..	53.50	46.17	49.45	49.46	52.83

*Weighed before feed or water were given.
†Based on warm weights of carcasses, dressed with "back sets" and with caul fat on.

EFFECT OF RATIONS ON PARASITIC INFESTATION

At the time they were slaughtered the lambs used in Experiment II were examined for stomach and intestinal parasites by D. C. Mote, in charge of animal parasite investigations at the Station. A few stomach worms were found in three of the lambs fed in the dry lot, and a fourth lamb was rather heavily infested with these parasites. Seven of the lambs in this lot carried a few hook worms, and a few tape worm segments were found in one lamb.

The lambs on bluegrass and on rye, clover and rape pastures showed about the same degree of infestation with stomach worms. The greatest difference between the lambs fed on the two kinds of pasture was with respect to the number of nodules present. The lambs on the bluegrass pasture showed a large number of nodules on the intestines, while only a few nodules were found in the lambs on rye, clover and rape pasture. Time did not permit the thorough examination of the intestines of all the lambs, but as far as the examination went, no tape worms were found in any of the lambs on pasture.

EXPERIMENT III

Object.—Experiment III was conducted to secure further data on the problems studied in Experiments I and II, and in addition, to compare a combination of rape and bluegrass pastures with either of the two pastures used alone, and to compare crossbred Shropshire x Merino with Merino lambs with respect to rate and economy of gains.

Plan of experiment.—The experiment lasted from May 9 to October 15, 1917, inclusive, a period of 160 days. Eight lots of ten ewes and ten lambs in each lot were used. On July 6 the lambs were weaned and the ewes removed from the experiment.

Sheep used.—The ewes in the experiment were mainly high grade, and a few purebred, Merino ewes, mostly of the C type. The lambs in Lots 1 to 7, inclusive, were sired by purebred Delaine Merino rams. The use of a ram of some of the English Down breeds on these ewes doubtless would have produced a more satisfactory class of lambs for feeding purposes, but since it was desired to keep the ewe lambs to maintain the Merino breeding flock, Merino sires were used. The lambs in Lot 8 were sired by a purebred Shropshire ram. The illustrations on pages 66 to 69 will show the kind of lambs used in the experiment. The photographs from which the illustrations were made were taken near the close of the experiment. Until the time the experiment began, the ewes and lambs were confined to the barn and dry lot.

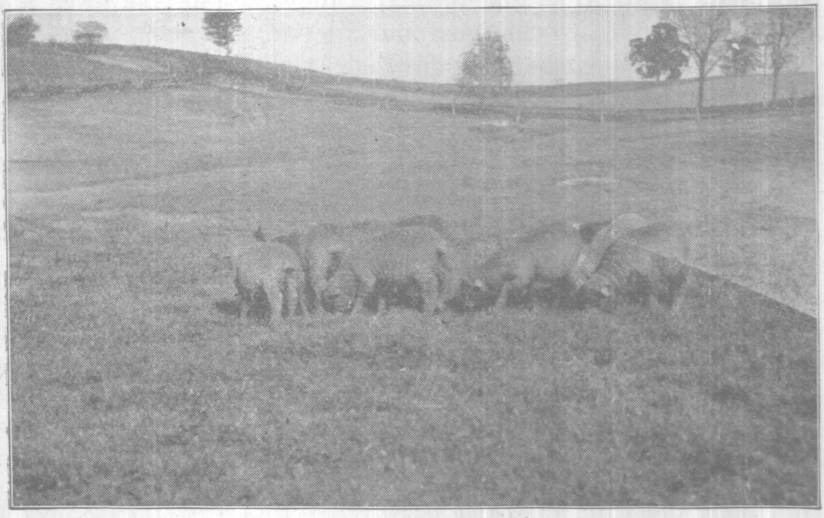
The ewes and lambs were divided so as to make the lots as nearly uniform as possible in every respect.

Rations.—The following rations were fed:

Lot 1. Corn and alfalfa hay in dry lot.
Lot 2. Bluegrass pasture.
Lot 3. Bluegrass pasture and corn.
Lot 4. Rye pasture, May 9 to May 30, inclusive.
Clover pasture, May 31 to July 5, inclusive.
Rape pasture, July 6 to October 15, inclusive.
Lot 5. Pasture same as Lot 4, and corn.
Lot 6. Rye pasture, May 9 to May 30, inclusive.
Clover pasture, May 31 to July 5, inclusive.
*Rape and bluegrass pasture, July 6 to September 20, inclusive.
Bluegrass pasture, September 21 to October 15, inclusive.
Lot 7. Pasture same as Lot 6, and corn.
Lot 8. Shropshire x Merino lambs. Ration same as that for Lot 4.

*By September 20 the rape was practically all eaten, and while the lambs still had access to the rape plot until the close of the experiment, it furnished little or no feed for them.

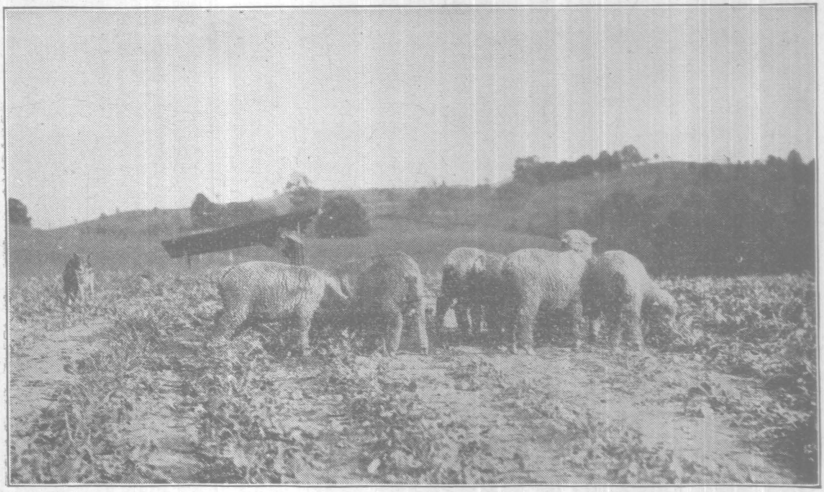
Lot 1. Merino lambs in Experiment III. Corn and alfalfa (dry lot)



Lot 2. Merino lambs in Experiment III. Bluegrass pasture

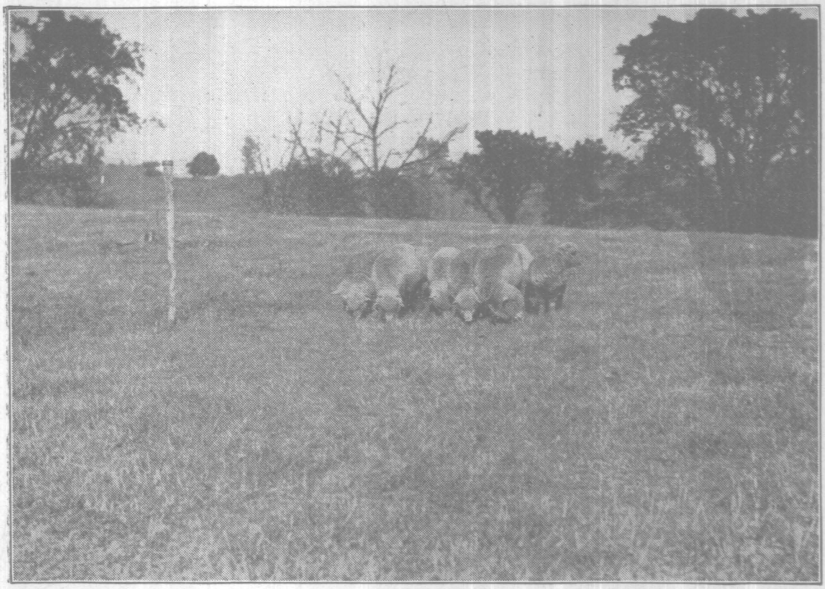
Lot 3. Merino lambs in Experiment III. Bluegrass pasture and corn

Lot 4. Merino lambs in Experiment III. Rye, clover and rape pasture



Lot 5. Merino lambs in Experiment III. Rye, clover and rape pasture and corn

Lot 6. Merino lambs in Exoeriment III. Rye, clover, bluegrass and rape pasture



Lot 7. Merino lambs in Experiment III. Rye, clover, bluegrass and rape pasture and corn

Lot 8. Shropshire x Merino lambs in Experiment III. Rye, clover and rape pasture

Table XI shows the average amount of feed, aside from pasture, consumed daily per head for each lot which was fed grain, for 4-week periods.

TABLE XI,—EXPERIMENT III. AVERAGE DAILY FEED, ASIDE FROM PASTURE, CONSUMED PER HEAD FOR 4-WEEK PERIODS

Period	Lot 1				Lot 3	Lot 5	Lot 7
	Ewes		Lambs		Lambs	Lambs	Lambs
	Corn	Alfalfa	Corn	Alfalfa	Corn	Corn	Corn
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
May 9 to June 5	.65	2.88	.25	.90	.25	.25	.25
June 6 to July 3	.59	2.69	.25	1.00	.25	.25	.25
July 4 to July 31	.....	.....	.29	1.24	.29	.29	.29
August 1 to August 28	.....	.....	.30	1.09	.30	.30	.30
August 29 to September 25	.....	.....	.39	1.02	.42	.42	.42
September 26 to October 15[*]	.....	.....	.48	.96	.54	.54	.54
May 9 to October 15[†]	.62	2.78	.32	1.05	.33	.33	.33

*20 days in this period.
†May 9 to July 5, inclusive, for the ewes.

It was planned to feed the lambs in all the lots the same amount of corn and to increase the corn ration gradually during the latter part of the summer so as to produce a good finish on the lambs by the time the experiment closed, but the lambs refused to eat as much corn as it was intended to feed. During the early part of the experiment the amount of corn fed was perhaps somewhat less than would have been consumed, but during the latter part the lambs were fed up to the limit of their appetite. For some unknown reason the lambs in Lot 1 were off feed and unthrifty, and made very poor gains after they were weaned. No feed, aside from pasture, was fed to any of the ewes except those in Lot 1.

Feeds used.—Shelled corn and alfalfa hay of good quality were used. The rye pastured was sown as a cover crop in the autumn of 1916. The clover, which consisted mostly of the medium red variety with a slight mixture of alsike, was seeded in the spring of 1916. Both the clover and rye furnished an abundance of pasture. The rape was of the same variety as that used in Experiment II, and was raised in a similar manner and on similar land (see p. 50). The rape made a poorer growth than is to be expected from the nature of the soil on which it was raised. The growth was retarded by wet, cold weather in the spring and by a serious drouth after July 1. The rape which was intended to carry the lambs throughout the experiment was seeded May 11 and May 14, seeding being delayed by the cold, wet weather. Because of the drouth, this rape was practically all eaten by September 20, and after that date the lambs

were put onto another piece of rape which was seeded July 30. This rape made a fair growth, even though the weather was very dry.

Lots 2, 3, 6 and 7 were pastured in the same field that was grazed by Lots 2 and 3 in Experiment II (see p. 52). Two plots containing approximately 1.8 and 1.4 acres were fenced off for Lots 6 and 7, respectively. The remainder of the field, containing 7.9 acres, was divided into two plots of approximately equal size for Lots 2 and 3. These two lots of lambs were shifted from one plot to the other every 2 weeks to overcome any differences which might exist in the pasture.

TABLE XII—EXPERIMENT III. AREA OF PASTURE GRAZED BY EWES AND LAMBS.

Pasture	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Bluegrass	3.95	3.95	.....	.....	1.822	1.424	.....
Rye	.....	.....	833	.787	.483	.795	.503
Clover	.....	.....	.903	.907	1.000	.907	1.000
Rape	.....	.....	.665	.696	.5	.5	1.159

The area of pasture grazed by each lot in the experiment is shown in Table XII. The bluegrass, rye and clover were pastured by both ewes and lambs. The rape was pastured by the lambs only.

Method of feeding and handling.—The details of the experiment were very similar to those of Experiment II (see p. 53). Until the time they were put onto rape pasture, Lots 6 and 7 were handled the same as Lots 4 and 5, respectively. After they were put onto rape, Lots 6 and 7 also had access to the bluegrass plots described on p. 52. For a few days until the lambs became accustomed to the rape, they were confined to it for a few hours each morning; after that they had access to the bluegrass or rape at will.

On July 6 and August 24 the lambs in all lots except Lot 1 were given the blue vitriol treatment for stomach worms and tape worms.

WEIGHTS AND GAINS

The initial weights were secured by averaging three weights taken on successive days. The final weights of both ewes and lambs were secured by averaging two weights taken on successive days. The ewes and lambs were weighed every 2 weeks during the experiment. All weights were taken shortly after noon, after the sheep had access to their usual feed and water. The initial and final weights and the rate of gain both before and after weaning are shown in Table XIII.

TABLE XIII, EXPERIMENT III.—WEIGHTS AND GAINS.

Ten ewes and ten lambs in each lot; test lasted 160 days, May 9 to October 15, 1917, inclusive

Ewes and lambs before weaning, May 9 to July 5, inclusive

	Lot 1 Corn and alfalfa Dry lot		Lot 2 Bluegrass		Lot 3 Bluegrass and corn		Lot 4 Rye and clover	
	Ewes	Lambs	Ewes	Lambs	Ewes	Lambs	Ewes	Lambs
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Initial wt. May 7, 8, and 9	758.5	313.5	756.5	323.5	740.	310.	753.5	315.
Weight July 4 and 5	782.5	437.5	725.0	425.0	722.5	440.	755.	445.
Total gain	24.	124.0	31.5	101.5	17.5	130.	1.5	130.
Av. daily gain per head	... ...	.214	.....	.175	.....	.224	.....	.224

Lambs after weaning, July 6 to October 15, inclusive

	Lot 1 Corn and alfalfa Dry lot	Lot 2 Bluegrass	Lot 3 Bluegrass and corn	Lot 4 Rape
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
Final wt., Oct. 15 and 16	512.5	517.5	572.5	572.5
Total gain	75.	92.5	132.5	127.5
Av. daily gain per head	.074	.091	.130	.125

Lambs during entire experiment, May 9 to October 15, inclusive

	Lot 1	Lot 2	Lot 3	Lot 4
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
Total gain	199.	194.	262.5	257.5
Av. daily gain per head	.124	.121	.164	.161

Ewes and lambs before weaning, May 9 to July 5, inclusive

	Lot 5 Rye, clover and corn		Lot 6 Rye and clover		Lot 7 Rye, clover and corn		Lot 8 Crossbred lambs Rye and clover	
	Ewes	Lambs	Ewes	Lambs	Ewes	Lambs	Ewes	Lambs
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Initial wt., May 7, 8 and 9	776.5	305.	748.5	313.5	781.5	306.5	746.5	375.
Weight July 4 and 5	760.	460.	750.	442.5	*725.	*412.5	790.	542.5
Total gain	—16.5	155.	1.5	129.	8.5	137.	43.5	167.5
Av. daily gain per head	.....	.267	.....	.222	.....	.251	.....	.289

Lambs after weaning, July 6 to October 15, inclusive

	Lot 5 Rape and corn	Lot 6 Rape and bluegrass	Lot 7 Rape, bluegrass and corn	Lot 8 Crossbred lambs Rape
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
Final wt., Oct. 15 and 16	617.5	†460.	‡542.5	727.5
Total gain	157.5	62.5	142.	185.
Av. daily gain per head	.154	.065	.143	.181

Lambs during entire experiment, May 9 to October 15, inclusive

	Lot 5	Lot 6	Lot 7	Lot 8
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*
Total gain	312.5	191.5	279.	352.5
Av. daily gain per head	.195	.124	.181	.220

*One lamb died in Lot 7, June 2, weight 31 pounds. On July 7 one lamb, weighing 48 pounds, was put into this lot. On June 3, one ewe weighing 65 pounds was removed from Lot 7.

†One lamb, weighing 45 pounds, died in Lot 6, August 22.

‡One lamb, weighing 60 pounds, died in Lot 7, September 24.

The fact that smaller gains were made in Experiment III than were made by corresponding lots in Experiment II (Table III, p. 54) is probably due, in part at least, to the breeding of the lambs. The lambs used in Experiment II were a Southdown x Merino cross, while those used in all lots except Lot 8 in Experiment III were Merinos. Seasonal differences doubtless had their influence, and that the general thrift of the lambs may also have been a contributing factor in producing smaller gains is indicated by the fact that the crossbred lambs in Lot 8, Experiment III made smaller gains than did the crossbred lambs similarly fed in Lot 4, Experiment II.

As has previously been stated, the lambs in Lot 1 were very unthrifty after weaning, from some unknown cause. Before weaning, Lot 1 made the largest gain of any of the lots, but after weaning this lot made the smallest gain. As in Experiment II, the gains from bluegrass pasture were materially smaller than those from the succession of rye, clover and rape pastures. In Experiment III the increase in the rate of gain due to feeding corn on pasture was greater than in Experiment II.

Table XIII shows that the Shropshire x Merino lambs in Lot 8 made a larger gain both before and after weaning than did any of the lots of Merino lambs.

As in Experiment II, some lots of ewes gained while other lots lost in weight when suckling their lambs in the experiment. There is no consistent evidence from Experiments II and III that the kind of pasture used or the feeding of corn to the lambs had any influence on the gain or loss in weight by the ewes.

When lambs graze on rape, they very greedily eat any grass growing along the fences or which can be reached through the fences. Because of this desire for grass when on rape pasture, it was thought that a combination of bluegrass and rape pastures might give better results than either pasture alone. A comparison of the average daily gains made by Lots 2, 4 and 6 and by Lots 3, 5 and 7, after the lambs were weaned and when they were on rape or rape and bluegrass pastures, shows that with respect to rate of gain, bluegrass or rape alone was usually better than a combination of the two, whether the lambs were fed pasture alone or whether they were fed corn in addition to the pasture. The only exception is in the case of Lots 3 and 7, where rape, bluegrass and corn made an average daily gain of .143 pound while bluegrass and corn made an average daily gain of .130 pound. This comparison, however, is not fair to Lots 6 and 7. As has previously been stated, the rape in the

plots used by Lots 6 and 7 was practically all eaten by September 20, and after that date the lambs had to subsist on bluegrass alone at a time when the bluegrass pasture was dry and unpalatable. More useful data on this point may be found from Table XIV, which shows the average weight of the lambs in Lots 2 to 7, inclusive, at frequent intervals after they were weaned. The average rather than the total weights are shown because one lamb in Lot 6 died on August 22 and one lamb died in Lot 7 on September 24. Table XIV shows that as long as they had rape, the two lots on rape and bluegrass (Lots 6 and 7) were heavier than the lots on bluegrass (Lots 2 and 3). There was no consistent difference in weight between the lot on rape (Lot 4) and the lot on rape and bluegrass (Lot 6) when no corn was fed, but when corn was fed in addition to the pasture, the lambs on rape and bluegrass (Lot 7) were heavier than those on rape (Lot 5).

TABLE XIV, EXPERIMENT III.—AVERAGE WEIGHT OF LAMBS AT INTERVALS AFTER WEANING

Date	Lot 2 Bluegrass		Lot 3 Bluegrass and corn		Lot 4 Rape		Lot 5 Rape and corn		Lot 6 Bluegrass and rape		Lot 7 Bluegrass, rape and corn	
	No.	*Lbs.*	*No.*	*Lbs.*	*No.*	*Lbs.*	*No.*	*Lbs.*	*No.*	*Lbs.*	*No.*	*Lbs.*
July 4 and 5	10	42.5	10	44.0	10	44.5	10	46.0	10	44 25	9	45.83
July 10... ...	10	39.5	10	42 0	10	44.5	10	45.0	10	42.50	10	45.50
July 26.....	10	43.0	10	46.0	10	44 5	10	47.0	10	45.00	10	49.50
August 9....	10	44.0	10	47.0	10	48.0	10	49 5	10	46.00	10	53.50
August 23...	10	46.5	10	51.0	10	50·0	10	52.0	9	48.89	10	54.50
September 5	10	46.5	10	51.0	10	50.5	10	54.0	9	51.11	10	57.00
September 20	10	50.0	10	54.5	10	53 0	10	58.0	9	52.22	10	58.00
Oct. 15 and 16	10	51.75	10	57.25	10	57.25	10	61.75	9	51.11	9	60.30

COST OF GAINS

Table XV shows the cost of the feed per 100 pounds of gain produced by the different lots with corn, hay and pasture at different prices. For the reason stated on p. 55 this comparison applies only to the period of the experiment which elapsed after the lambs were weaned.

Table XV shows the cost of gains produced by rape and by bluegrass, without corn, to be approximately equal with rape valued at three to four times as much per acre as bluegrass. A better comparison of the value of rape and bluegrass may be had from Table XVIII, which shows the amount of gain produced by an acre of each kind of pasture.

A comparison of Lots 4 and 8 shows that during the period after the lambs were weaned, the Shropshire x Merino lambs made more expensive gains than did the Merino lambs similarly fed.

Since the lambs fed in the dry lot (Lot 1) produced abnormally small gains after weaning, the cost of the gains was abnormally high and does not permit a fair comparison of the economy of raising lambs in dry lot and on pasture.

TABLE XV, EXPERIMENT III.—COST OF FEED PER 100 POUNDS OF GAIN MADE AFTER LAMBS WERE WEANED

102 days, July 6 to October 15, inclusive

Feed price combination†	Lot 1 Corn and alfalfa Dry lot	Lot 2 *Blue-grass	Lot 3 *Blue-grass and corn	Lot 4 Rape	Lot 5 Rape and corn	Lot 6 *Blue grass and rape	Lot 7 *Blue-grass, rape and corn	Lot 8 Crossbred lambs Rape
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
1	13.19	9.15	9.30	5.22	6.87	14.25	8.30	6.26
2	19.78	13.73	13.95	7.82	10.30	21.37	12.45	9.40
3	26.37	18.30	18.60	10.43	13.74	28.49	16.60	12.53
4	39.56	27.45	27.90	15.65	20.61	42.74	24.91	18.79

*Bluegrass charged for 3 months, or three-sevenths of total price for the season.

†Feed price combinations are as follows:

Combination	Corn, per bu.	Hay, per ton	Bluegrass, per acre	Rape, per acre
1	$ .56	$10	$ 5.00	$10
2	.84	15	7.50	15
3	1.12	20	10.00	20
4	1.68	30	15.00	30

As in Experiments I and II (see Table IV), the feeding of grain on rape or bluegrass pasture increased the cost of gains at all the combinations of feed prices shown in Table XV. When corn was fed to the lambs on the combination of bluegrass and rape pastures (compare Lots 6 and 7) the cost of gains was lowered. A comparison of the cost of gains in Lots 5 and 7 shows that this is true not because the gains were cheap in Lot 7, but because of the failure of the rape at a season when the bluegrass was unpalatable, the cost of the gain produced by Lot 6 was abnormally high. For the reasons stated on p. 56, a better basis for determining the economy of feeding corn on pasture is furnished by Table XVI, which shows the amount of additional gains resulting from feeding corn, the amount of corn consumed and the net cost of the corn consumed for each 100 pounds of additional gain, after making allowance for the greater value of the corn-fed lambs. Like Table V, this table does not consider the greater amount of green feed which probably was eaten by the lambs fed on pasture alone. A probable source of error in connection with Table XVI lies in the fact that, as stated on p. 81, the lambs were probably not sold on such a basis that the market prices, and consequently the home values, are a true index to the relative values of the different lots. The results of the slaughter test (Table XX) indicate that there was a greater difference in favor of the corn-fed lambs than is shown by

the market price. As a result, the net cost of the additional gain resulting from feeding corn, as shown in Table XVI, is somewhat greater than it would have been had the market prices of the various lots of lambs been in keeping with their merit as shown by the slaughter test.

TABLE XVI, EXPERIMENT III.—NET COST OF CORN CONSUMED PER 100 POUNDS OF ADDITIONAL GAIN RESULTING FROM FEEDING CORN

	Lot 3 Bluegrass	Lot 5 Rye, clover and rape	Lot 7 Rye, clover, bluegrass and rape
Additional gain due to feeding corn.....Pounds..	68.5	55.0	87.5
Corn consumed.....Pounds..	531	531	512
Additional home value, per 100 lbs., of corn-fed lambs.Dollars.	.27†	.83	.51
Additional home value, per lot, of corn-fed lambs*..Dollars..	1.56	5.17	3.01
Net cost of corn consumed per 100 lbs. additional gain:			
Corn at $0.56 per bushel.....Dollars..	5.47	.25	2.41
Corn at $1.12 per bushel.....Dollars	13.23	9.91	8.26
Corn at $1.68 per bushel.....Dollars.	20.98	19.56	14.11

*This item represents the increase in value of the initial weight of the lambs and the additional value of the gain which resulted from feeding corn. In making this calculation the same initial weight was assumed for both lots on the same kind of pasture; otherwise, the heavier lots at the beginning of the experiment would have an unfair advantage.

†An abnormal difference in shrinkage made the home value per hundred pounds lower for Lot 3 than for Lot 2. Since the appearance of the lambs on foot and the results of the slaughter test (Table XX) indicate that the lambs in Lot 3 were worth more than those in Lot 2, the difference in the market price rather than the difference in the home value is used in this case.

Table XVI indicates that in this experiment corn could have been fed at a profit to lambs on bluegrass and on rye, clover and rape pastures with corn worth $0.56 or $1.12 per bushel, but not with corn worth $1.68 per bushel with lambs at the price received for those used in this experiment (see Table XIX). The results of Experiments I, II and III do not necessarily prove, however, that the rather common practice of feeding corn to lambs for a few weeks after weaning is not justified, or that corn may not profitably be fed to tide over periods when pasture is scant, even with corn worth $1.68 or more per bushel.

DAILY RETURN PER LAMB FROM PASTURE

Table XVII shows the value of the daily return per lamb from the different kinds of pasture, with lambs valued at different prices. In case of the lots fed corn, the value of the corn at $0.56 and $1.12 per bushel was deducted from the value of the returns. In such lots, any profit or loss from feeding corn is included in the value of the daily return per lamb, because of the impossibility of separating these two items. In computing Table XVII, no account was taken of the value of the gain or loss made by the ewes.

TABLE XVII, EXPERIMENT III.—DAILY RETURN PER LAMB FROM PASTURE

	Lot 2	Lot 3		Lot 4	Lot 5	
	Bluegrass	Bluegrass and corn		Rye, clover and rape	Rye, clover, rape and corn	
		Corn per bushel			Corn per bushel	
		$.56	$1.12		$ 56	$1.12
Lambs at $10 per 100 lbs.	.012	$.013	$.010	$.016	$.016	$.013
Lambs at $15 per 100 lbs.	.018	.021	.018	.024	.026	.023
Lambs at home values*...	.015	.017	.014	.019	.022	.018

	Lot 6	Lot 7		Lot 8
	Rye, clover bluegrass and rape	Rye, clover, bluegrass, rape and corn		Crossbred lambs
		Corn per bushel		Rye, clover and rape
		$.56	$1.12	
Lambs at $10 per 100 lbs.....	$.012	$ 015	$.011	$.022
Lambs at $10 per 100 lbs.....	.019	.024	.020	.033
Lambs at home values*.....	.015	.019	.016	.030

*Home values were as follows (see p. 80): Lot 2, $12.63; Lot 3, $12.44; Lot 4, $12.01; Lot 5, $12.84; Lot 6, $11.88; Lot 7, $12.39; Lot 8, $13.64.

As in Experiment II, the value of the daily return per lamb was greater from the lambs on rye, clover and rape pastures (Lots 4 and 5) than from those on bluegrass pasture (Lots 2 and 3), whether the lambs were fed on pasture alone or whether they were fed corn in addition to the pasture. The value of the daily return per lamb from the lambs on the rye, clover, bluegrass and rape pasture (Lots 6 and 7) was usually slightly higher than that from the lambs fed on bluegrass pasture (Lots 2 and 3) and was lower than the value of the return from the lambs fed on rye, clover and rape pastures (Lots 4 and 5). With any of the prices for lambs shown in Table XVII, the feeding of corn on pasture resulted in an increase in the value of the daily return per lamb from pasture, with corn valued at $0.56 per bushel, but with corn valued at $1.12 per bushel the value of such return was lowered, with a few exceptions, after deducting the value of the corn fed.

At all the prices for lambs shown in Table XVII, the crossbred lambs (Lot 8) made the most valuable daily return of any of the lots.

GAIN PER ACRE FROM DIFFERENT KINDS OF PASTURE

Table XVIII shows the amount of gain made by the lambs on each kind of pasture and the value of such gains with lambs valued at three different prices. The gain or loss made by the ewes was valued at 6 cents per pound. The value of the corn, at $1.12 per bushel, fed to Lots 3, 5 and 7 was deducted from the value of the gains made by the lambs in these lots. In these three lots, the profit or loss resulting from feeding corn is included in the value of

the returns per acre from pasture because of the impossibility of separating these items. For this reason Table XVIII probably does not show the exact value of the gains per acre from pasture in case of the lots that were fed corn.

Table XVIII shows something of the value of rye and clover as pasture crops for lambs. For the reasons stated on p. 60 this table does not show the full feeding value of these crops, particularly of clover, for the entire growing season.

TABLE XVIII, EXPERIMENT III.—GAINS MADE ON DIFFERENT KINDS OF PASTURE

Rye. 22 days, May 9 to May 30, inclusive

	Lot 4 Rye	Lot 5 Rye and corn	Lot 6 Rye	Lot 7 Rye and corn	Lot 8 Crossbred lambs Rye
Ewes on pasture....Number..	10	10	10	10	10
Lambs on pasture....Number..	10	10	10	10	10
Area of pasture grazed....Acre..	.833	.787	.483	.795	.503
Gain or loss, per acre, on ewes...Pounds..	19.81	—8.26	—69.36	4.4	—52.68
Gain, per acre, on lambs....Pounds..	48.02	69.89	44.51	73.58	59.64
Average daily gain on lambs....Pound..	.182	.25	.098	.266	.136
Value of gain on lambs, per acre:*					
Lambs at $10 per 100 lbs....Dollars..	5.99	5.09	.29	6.24	2.80
Lambs at $15 per 100 lbs....Dollars..	8.39	8.58	2.51	9.66	5.78

Clover. 36 days, May 31 to July 5, inclusive

	Lot 4 Clover	Lot 5 Clover and corn	Lot 6 Clover	Lot 7 Clover and corn	Lot 8 Crossbred lambs Clover
Ewes on pasture....Number..	10	10	10	10†	10
Lambs on pasture....Number..	10	10	10	10†	10
Area of pasture grazed....Acre..	.903	.907	1	.907	1
Gain or loss, per acre, on ewes...Pounds..	—16.61	—11.03	35	5.51	70
Gain, per acre, on lambs....Pounds..	99.67	110.25	107.5	86.55	137.5
Average daily gain on lambs....Pound..	.257	.286	.307	.248	.393
Value of gain on lambs, per acre:*					
Lambs at $10 per 100 lbs....Dollars..	8.97	8.43	12.85	7.19	17.95
Lambs at $15 per 100 lbs....Dollars..	13.95	13.94	18.22	11.51	24.82

Rape. 77 days, July 6 to September 20, inclusive

	Lot 4 Rape	Lot 5 Rape and corn	Lot 8 Crossbred lambs Rape
Lambs on pasture....Number..	10	10	10
Area on pasture grazed....Acre..	.412	.43	.826
Gain, per acre, on lambs....Pounds..	206.31	279.07	148.31
Average daily gain on lambs....Pound..	.109	.154	.157
Value of gain on lambs, per acre:*			
Lambs at $10 per 100 lbs....Dollars..	20.63	16.05	14.83
Lambs at $15 per 100 lbs....Dollars..	30.99	30.00	22.24
Lambs at home values‡....Dollars..	24.78	23.97	20.23

TABLE XVIII, EXPERIMENT III.—GAINS MADE ON DIFFERENT KINDS OF PASTURE—Concluded

Rape. 25 days, September 21 to October 15, inclusive

	Lot 4 Rape	Lot 5 Rape and corn	Lot 8 Crossbred lambs Rape
Lambs on pasture.....Number..	10	10	10
Area of pasture grazed.....Acre..	.253	.266	.333
Gain, per acre, on lambs.....Pounds.	167.98	140.98	187.69
Average daily gain on lambs.....Pound.	.17	.15	.25
Value of gain on lambs, per acre:*			
Lambs at $10 per 100 lbs.....Dollars..	16.80	4.06	18.77
Lambs at $15 per 100 lbs.....Dollars..	25.20	11.11	28.15
Lambs at home values‡.....Dollars.	20.17	8.06	25.60

Bluegrass. 160 days, May 9 to October 15, inclusive

	Lot 2 Bluegrass	Lot 3 Bluegrass and corn
Ewes on pasture.....Number	10	10
Lambs on pasture.....Number..	10	10
Area of pasture grazed.....Acres..	3.95	3.95
Gain or loss, per acre, on ewes.....Pounds..	—7.97	4.43
Gain, per acre, on lambs.....Pounds..	49.11	66.46
Average daily gain on lambs.....Pound.	.121	.164
Value of gain on lambs, per acre:*		
Lambs at $10 per 100 lbs.....Dollars..	4.43	4.23
Lambs at $15 per 100 lbs.....Dollars.	6.88	7.55
Lambs at home values‡.....Dollars.	5.72	5.84

*Where ewes were pastured with the lambs, the gain or loss by the ewes was valued at 6 cents per pound. The value of the corn (at $1.12 per bushel) fed to Lots 3, 5 and 7, was deducted from the value of the gains made by these lots.

†One lamb in Lot 7, weighing 31 pounds, died June 2. Its dam, weighing 65 pounds, was removed from the lot on June 3.

‡Home values were as follows (see p. 80): Lot 2, $12.63 per 100 pounds; Lot 3, $12.44 per 100 pounds; Lot 4, $12.01 per 100 pounds; Lot 5, $12.84 per 100 pounds; Lot 6, $11.88 per 10 0pounds; Lot 7, $12.39 per 100 pounds; Lot 8, $13.64 per 100 pounds.

Table XVIII shows that an acre of rape produced from two and one-half to four times as much gain as did an acre of bluegrass. With the gains valued at the estimated home prices for the lambs (see p. 80), the value of the returns from an acre of rape was about four times as great as from an acre of bluegrass. Table XVIII does not show the maximum gains that may be expected from an acre of rape under more favorable conditions. Because of drouth, the first plot of rape used by each lot made practically no growth after September 20, and the lambs were then put on rape which was not sown until July 30 and which was not all eaten by the time the experiment closed. In calculating this table all the rape was treated as though it had been utilized throughout the growing season.

The gains produced by bluegrass pasture were smaller than are to be expected from bluegrass on better soil.

Lots 4 and 8, Table XVIII, afford a comparison of the returns per acre by Merino and by Shropshire x Merino lambs when similarly treated. During the first period after they were weaned,

from July 6 to September 20, the crossbred lambs (Lot 8) made a greater average daily gain per head but a smaller return per acre than did the Merino lambs (Lot 4). This comparison, however, is not fair to Lot 8, as the rape grazed by Lot 8 was not of as good quality as that grazed by Lot 4. During the period from September 21 to October 15, when the two lots were on rape of similar quality, the crossbred lambs made a larger average daily gain per head and a greater gain per acre than did the Merino lambs, although there is no indication that the returns per acre for the crossbred lambs would have been greater had the lambs in both lots been on pasture long enough to make a like utilization of the rape.

MARKET FINISH AND PRICE, COST OF MARKETING AND HOME VALUES

At the close of the experiment, all the Merino wether lambs and all the crossbred lambs (Lot 8) were shipped to Cleveland, Ohio. Since the lambs were sold direct to a packing firm no charge was made for commission. The freight, feed and yardage charges amounted to $1.02 per 100 pounds. Owing to congested traffic conditions it was necessary to feed the lambs enroute, adding a cost of $2.50 which ordinarily would not be made. The cost of marketing was considerably greater than it would have been had there been a full load of lambs.

When the lambs arrived at market they were divided into two lots, one of which sold for $14.50 and the other for $15.75 per 100 pounds. The average selling price of each lot of lambs is shown in Table XIX. This table also shows the cost of marketing and the estimated home value of each lot, after deducting the cost of marketing and making allowance for the shrinkage in shipping.

TABLE XIX, EXPERIMENT III.—MARKET AND HOME PRICES AND COST OF MARKETING

	Lot 1 Corn and alfalfa Dry lot	Lot 2 Blue-grass	Lot 3 Blue-grass and corn	Lot 4 Rye, clover and rape	Lot 5 Rye, clover, rape and corn	Lot 6 Rye, clover, bluegrass and rape	Lot 7 Rye, clover, bluegrass, rape and corn	Lot 8 Cross-bred lambs Rape
Market price, per 100 lbs..	$14.50	$14.86	$15.13	$15.18	$15.31	$14.50	$15.19	$15.75
Cost of marketing, per lot.	1.65	1.86	2.44	2.25	2.89	2.38	2.27	6.75
Home values, per 100 lbs..	12.13	12.63	12.44	12.01	12.84	11.88	12.39	13.64

Some idea of the finish carried by the different lots may be had from the average market prices shown in Table XIX and from the yields of dressed carcass shown in Table XX. Definite conclusions, however, cannot be drawn from these tables, as the ewe lambs were

not marketed, except in Lot 8. The lots do not bear the same relation to each other with respect to yield of dressed carcass that they bear with respect to market price, which indicates that the lambs were not sold on such a basis that the prices paid are a true index to the relative values of the different lots.

SLAUGHTER TEST AND SHRINK IN SHIPPING

The wether lambs in Lots 1 to 7, inclusive, and all the lambs in Lot 8 were shipped from Carpenter on October 25 and did not arrive in Cleveland until October 29. The lambs were fed and watered on arrival at Cleveland but were fasted for 24 hours before they were weighed, which accounts for the abnormally large shrink in shipping shown in Table XX. This table shows that with the exception of Lots 2 and 8, the dry-fed lot (Lot 1) shrank less in shipping than did the pasture-fed lots. The kind of pasture used or whether or not corn was fed seems to have had no consistent influence on the amount of shrinkage in shipping.

TABLE XX, EXPERIMENT III.—SLAUGHTER TEST AND SHRINK IN SHIPPING

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8
Lambs shipped.....Number..	4	4	4	4	5	5	4	10
Home weight, Oct. 25....Pounds..	180.	200.	270.	260.	315.	265.	255.	715.
Cleveland wt., Oct. 29.. Pounds..	162.	182.5	238.	220.5	283.	233.5	223.	662.25†
Shrinkage in shipping, Percent..	10.	8.75	11.85	15.19	10.16	11.83	12.55	7.38†
Yield of dressed carcass* Percent..	41.05	40.55	43.48	41.72	49.12	42.18	47.53	47.79†

*Based on warm weight of carcasses, dressed with "back sets" and with caul fat on.

†When the lambs were weighed at the packing house prior to killing, one lamb in Lot 8 crawled under the gate unweighed and unnoticed. The live weight for this lot at Cleveland, the shrink in shipping and the yield were calculated by assuming that this lamb lost the same amount as did the others between October 15, when all the lambs were weighed individually, and October 30, when the lambs were slaughtered in Cleveland.

Since only the wether lambs were shipped from Lots 1 to 7, inclusive, it is quite possible that the proportion of dressed carcass to live weight shown in Table XX does not correctly express the relative merits of these lots. From the data presented in Table XX, it may be seen that Lots 4 and 5, fed on rape pasture, and Lots 6 and 7, fed on rape and bluegrass pasture after weaning, yielded a larger proportion of dressed carcass than did Lots 2 and 3 fed on bluegrass pasture. The yield of dressed carcass was also increased by feeding corn, as may be seen by comparing Lots 3, 5 and 7 with Lots 2, 4 and 6, respectively. The yield of dressed carcass of the Shropshire x Merino lambs (Lot 8) was greater than the average for the Merino lambs, but was exceeded by that of the Merino lambs in Lot 5. The yield of dressed carcass from the lambs fed in dry lot (Lot 1) was smaller than that of any other lot except Lot 2. The

low yield of Lot 1 is attributable to the exceptionally poor gains made by this lot. During the last week before the lambs were shipped, after the close of the experiment, all lots were kept in the barn and fed on corn and hay. This would have a tendency to minimize differences in shrink in shipping and in yield of dressed carcass.

CONCLUSIONS FROM EXPERIMENTS I, II AND III

It could scarcely be expected that thoroughly dependable information on the problems involved in fattening lambs on pasture could be secured except from a large number of experiments covering a long period of time and a wide range of conditions. However, the three experiments which have just been reported seem to warrant a few conclusions, tentative at least.

COMPARISON OF BLUEGRASS WITH RAPE AND WITH RYE, CLOVER AND RAPE PASTURE

In making this comparison, consideration has been given only to the lots which received no grain while on pasture, as the feeding of grain would have a tendency to obscure the comparison of the different kinds of pasture.

Rate of gain.—In Experiment I the lambs on rape made 2.73 percent greater average daily gain per head than did the lambs on bluegrass. When a succession of rye, clover and rape pasture was compared with bluegrass pasture, the difference in the average daily gain per head in favor of the rye, clover and rape was 19.79 percent in Experiment II and 33.06 percent in Experiment III. See Tables III and XIII, pages 54 and 72.

Gain per acre of pasture.—The high value of rape as a forage crop is shown by the amount of gain produced by an acre of bluegrass and by an acre of rape pasture. In Experiments I, II and III, an acre of rape produced as much gain as 5.04, 9.25 and 8.19 acres of bluegrass, respectively, during the time the rape was pastured. If the bluegrass is given credit for the gain produced during the entire time it was pastured, an acre of rape produced as much gain as 3.53 acres of bluegrass in Experiment II and as much as 3.9 acres of bluegrass in Experiment III. In Experiment I, the rape pasture carried at the rate of 16.3 lambs per acre for 131 days and produced at the rate of 241.8 pounds of gain per acre. In Experiment II, the rape carried at the rate of 8.9 lambs per acre for 97 days and produced at the rate of 186.6 pounds of gain per acre. In Experiment III, one plot of rape carried at the rate of 24.3 lambs per acre for 77 days and produced at the rate of 206.3 pounds of gain per acre. In

the latter part of the same experiment, another plot of rape carried at the rate of 39.5 lambs for 25 days and produced at the rate of 168 pounds of gain per acre. See Tables VII and XVIII, pages 59 and 78.

Cost of gains.—Owing to the impossibility of assigning exact values to the various kinds of pasture used, it is not possible to calculate the exact cost of the gains produced by the lambs. Tables IV and XV, pages 55 and 75, furnish a basis for comparing the cost of gains produced by rape and bluegrass pastures. By assuming arbitrary values of $5, $7.50, $10 and $15 per acre for bluegrass and $10, $15, $20 and $30 per acre for rape, these tables show that the cost of the gains made on rape and bluegrass pasture was approximately equal when rape was valued at three to four times as much per acre as bluegrass.

Market finish and price.—In all three experiments the lambs on rape pasture or on rye, clover and rape pasture produced a better finish than those on bluegrass. In Experiments II and III,, when the lambs were sold soon after the close of the experiment, the lambs fed on rye, clover and rape had a slightly higher market value than those fed on bluegrass, as is shown by Tables IX and XIX, pages 63 and 80.

Shrink in shipping.—Table X, page 64, shows that the lambs fed on bluegrass in Experiment II shrank more in shipping than did the lambs on rye, clover and rape. Table XX, page 81, shows that in Experiment III the lambs on bluegrass shrank less than did those on rye, clover and rape.

Yield of dressed carcass.—Slaughter tests were secured in Experiments II and III, and in both cases the lambs fed on rye, clover and rape pasture yielded a larger proportion of dressed carcass to live weight than did those fed on bluegrass. See Tables X and XX, pages 64 and 81.

The results of these three experiments indicate that rape is a valuable forage crop for fattening lambs, particularly in sections of the state where bluegrass pastures are not abundant. Even where permanent pastures are abundant rape may often be used advantageously, particularly to supplement bluegrass pastures during the part of the summer when they are likely to be dry, unpalatable, and infested with parasites.

THE ECONOMY OF FEEDING CORN TO LAMBS ON PASTURE

Rate and cost of gains.—Tables III and XIII, pages 54 and 72, show that feeding corn to lambs on pasture resulted in larger daily gains per lamb in all three experiments. The increased rate of gain

due to feeding corn was usually, but not always, greater when the lambs were on bluegrass than when they were on rape or on rye, clover and rape. Tables V and XVI show that corn was profitably fed when the corn was valued at $0.56 and in some instances as high as $1.12 a bushel but when it was valued as high as $1.68 a bushel the net cost of the corn required to produce 100 pounds of additional gain was greater than the price received for the lambs. The prices which were received for the lambs (see Tables IX and XIX), particularly in Experiment II, were lower than prices which usually prevail when corn is worth $1.68 a bushel, and with higher prices for lambs there is usually a greater premium paid for the higher finish carried by corn-fed lambs. It is entirely possible that with higher prices for lambs, the corn-fed lambs would command a sufficient premium to pay for the corn, with corn valued at $1.68 or at an even higher price a bushel. The data yielded by these experiments do not indicate that even high-priced grain may not profitably be fed to fattening lambs when an abundance of good pasture is not available, or for a short time after weaning, as is frequently done.

Market finish and price.—In all three experiments, the lambs fed corn in addition to pasture produced a better finish and had a higher market value than those that were not fed corn.

Shrink in shipping.—Table X, page 64, shows that the corn-fed lambs in Experiment II shrank less in shipping than did the lambs on pasture alone. Table XX, page 81, shows that the different lots of corn-fed lambs in Experiment II were not consistent in this respect.

Yield of dressed carcass.—Tables X and XX, pages 64 and 81, show that the lambs fed corn in addition to pasture yielded a larger proportion of dressed carcass to live weight than those that were not fed corn.

COMPARISON OF RAISING LAMBS IN DRY LOT AND ON PASTURE

Rate and cost of gains.—For some unknown reason, the lambs in the dry lot in Experiment III made abnormally poor gains after weaning and cannot be used in this comparison. In Experiments I and II, the lambs in the dry lot made the largest average daily gain per head of any of the lots throughout the experiment. See Table III, p. 54. Table IV, p. 55, shows that with corn worth $0.56 and $0.84 per bushel and hay worth $10 and $15 per ton, the lambs fed in dry lot produced gains which compared rather favorably in cost with those produced by the lambs on pasture.

Finish and market price.—In Experiments I and II, the lambs fed in dry lot (Lot 1) produced a higher finish than any of the lots on pasture. Table IX, p. 63, shows that the lambs fed in dry lot had a higher market value than any of the other lots.

Shrink in shipping.—It seems reasonable to assume that the lambs fed on dry feed would shrink less in shipping than would lambs fed on pasture. Table X, p. 64, shows that one other lot in Experiment II shrank less than the lot fed in the dry lot. However, since the lambs on pasture received a small amount of dry feed for 5 days between the time the experiment closed and the time the lambs were shipped, Table X probably does not show the relative amount of shrinkage which may be expected from the lambs on dry feed and on pasture.

Yield of dressed carcass.—Table X shows that the lambs fed in dry lot yielded a larger proportion of dressed carcass to live weight than did any of the lots on pasture.

COMPARISON OF BLUEGRASS AND RAPE PASTURES ALONE AND COMBINED

Because there was not enough rape to last throughout the season for the lots which were to receive the combination of bluegrass and rape pastures, no definite conclusions can be drawn from the data yielded by Experiment III. Table XIV, p. 74, suggests that a combination of the two pastures may be better than either pasture alone, but more data are necessary to determine this point.

COMPARISON OF MERINO AND SHROPSHIRE x MERINO LAMBS

Rate and cost of gains.—The Shropshire x Merino lambs made 29 percent larger gains than the Merino lambs before weaning and 44.8 percent larger gains after weaning, as is shown by Table XIII, p. 72. Owing to the larger amount of rape pasture required to carry them (see Table XII, p. 71) the cost of the gains produced by the Shropshire x Merino lambs was greater than the cost of the gains produced by the Merino lambs, similarly fed, as is shown by Table XV, p. 75.

Gain produced per acre of pasture.—Table XVIII, p. 78, shows that the Shropshire x Merino lambs produced a larger gain per acre on rye and clover pasture than did Merino lambs similarly fed, but when on rape pasture the Merino lambs produced the larger gain on the first plot while the Shropshire x Merinos produced the greater gain on the second plot of rape used.

Market finish and price.—The Shropshire x Merino lambs produced a slightly higher finish and sold for $0.57 more per 100 pounds than did the Merino lambs similarly fed. See Table XIX, p. 80.

Shrink in shipping and yield of dressed carcass.—Table XX, p. 81, shows that the Shropshire x Merino lambs shrank the least in shipping of any of the lots. The same table shows that the Shropshire x Merino lambs yielded a larger proportion of dressed carcass to live weight than did the Merino lambs similarly fed.

EFFECT OF KIND OF PASTURE ON PARASITIC INFESTATION

The lambs fed on rye, clover and rape pasture were relatively free from nodules, while those on bluegrass were badly infested. Otherwise there was no noticeable difference in the degree of parasitic infestation of the lambs fed on the two kinds of pasture. Although such annual pastures as rape may not reduce the degree of infestation, it is probable that they may lessen the amount of damage done by parasites, particularly at times when permanent pastures are scant or unpalatable, by supplying an abundance of succulent feed and thus keeping the animals on a higher plane of nutrition.

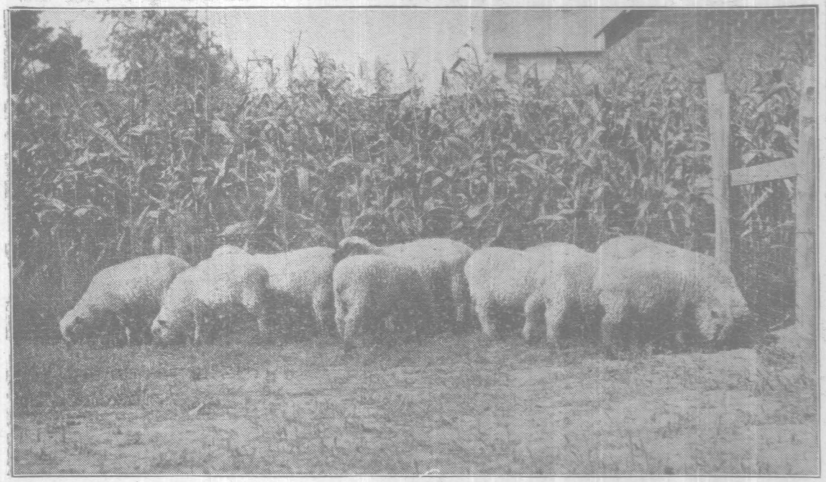
EXPERIMENT IV

Object.—Experiment IV was conducted with the following objects in view:

1. To secure data regarding the economy of feeding a full feed and one-half feed of corn to lambs on rape pasture.
2. To compare Shropshire and Shropshire x Merino lambs with respect to rate, economy and character of gains produced on rape pasture.

Plan of experiment.—Six lots of ten ewes and eleven lambs in each lot were used in the experiment, which was begun July 12, 1917. By September 19, the lambs in Lots 1, 2 and 3 had eaten all the rape on the plots assigned to them and they were taken out of the experiment. The lambs in Lots 4, 5 and 6 were continued on the experiment until October 2, until they had eaten all the rape on the plots on which they were pastured. On July 12 the ewes were turned into the rape plots with the lambs to get the lambs accustomed to the rape before they were weaned. On July 24 the lambs were weaned and the ewes were removed from the experiment.

Sheep used.—The ewes in Lots 1, 2 and 3 were mostly grade, and a few purebred, Shropshires. Any blood other than Shropshire that was carried by these ewes was probably that of some of the other English Down breeds. The ewes in Lots 4, 5 and 6 were probably purebred Merinos, although they were not recorded. They were mostly of the C type. All the lambs were sired by purebred Shropshire rams, and were born during March and April, 1917.

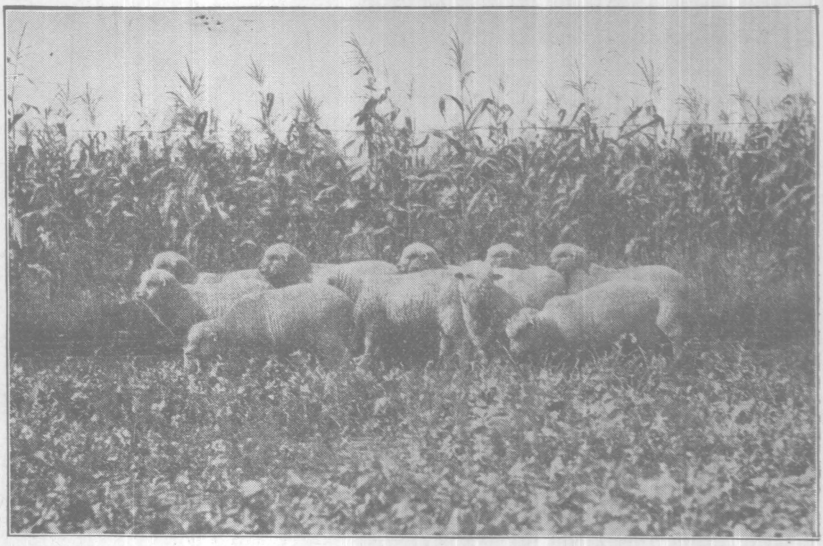


Lot 1. Shropshire lambs in Experiment IV. No corn

Lot 2. Shropshire lambs in Experiment IV. One-half feed of corn

Lot 3. Shropshire lambs in Experiment IV. Full feed of corn

Lot 4. Shropshire x Merino lambs in Experiment IV. No corn



Lot 5. Shropshire x Merino lambs in Experiment IV. One-half feed of corn

Lot 6. Shropshire x Merino lambs in Experiment IV. Full feed of corn

The Shropshires averaged 111.6 and the crossbreds 97.6 days of age at the time the experiment began. The illustrations on pages 87 to 89 show the kind of lambs used in the experiment. The photographs from which these illustrations were made were taken at the close of the experiment. Until the time the ewes and lambs were turned onto bluegrass pasture, about May 1, the lambs were fed no grain except what little they were able to secure from being allowed to run with their dams while eating. Between May 1 and July 12 the ewes and lambs were given the run of a bluegrass pasture on which no sheep had grazed for a number of years. During this period no grain was fed to either ewes or lambs. Both ewes and lambs were given the blue vitriol treatment for internal parasites about 10 days before the experiment began. The ewes and lambs were divided so that the different lots were as nearly alike as possible. Each lot contained one pair of twin lambs.

Rations.—The following is an outline of the experiment with respect to the rations fed and the breeding of the lambs in each lot:

Lot 1. Shropshire lambs—rape.
Lot 2. Shropshire lambs—rape and corn (one-half feed).
Lot 3. Shropshire lambs—rape and corn (full feed).
Lot 4. Shropshire x Merino lambs—rape.
Lot 5. Shropshire x Merino lambs—rape and corn (one-half feed).
Lot 6. Shropshire x Merino lambs—rape and corn (full feed).

No corn was fed to any of the lambs until after the ewes were removed on July 24. For the first week after weaning, the lambs in Lots 1 and 4 were fed a small amount of corn. Lots 3 and 6 were fed all the corn they would eat each morning. During the greater part of the experiment, Lots 2 and 6 were fed one-half the amount of corn that was eaten by Lots 3 and 6, respectively. During the first 2 weeks after the lambs were weaned, Lots 2, 3, 4 and 6 were all fed alike, as it was impossible to get the lambs to eat much corn until they became accustomed to it. Table XXI shows the amount of corn eaten daily per lamb by each lot for 4-week periods during the experiment, and the total amount eaten by each lot.

The average daily consumption of corn per head during the entire experiment was greater for Lots 5 and 6 than for Lots 2 and 3 because of the higher average rate of consumption for the 13 days they were continued on the experiment after Lots 2 and 3 were discontinued.

Feeds used.—The lambs were fed shelled corn of good quality. Each lot was allowed the run of a plot containing one-half acre, seeded to rape. Dwarf Essex rape was seeded with a grain drill,

all hoes running, and was not cultivated. As far as could be observed, the rape made as satisfactory growth as in former years when it was seeded in rows about 28 inches apart and was given frequent cultivations, although no rape was seeded in the latter manner for comparison. The early part of the summer was very cold and wet and the rape grew slowly. About June 20 the weather turned warm and the rape grew rapidly, so that it was between 2 and 3 feet high when the experiment was started. There were a few weeks of hot, dry weather late in July and early in August when the rape did not grow well. Later rains revived the rape so that it made good growth during the late summer and autumn.

TABLE XXI, EXPERIMENT IV.—CORN CONSUMED DAILY PER HEAD FOR 4-WEEK PERIODS, AND TOTAL CORN CONSUMED

Period	Shropshire lambs			Shropshire x Merino lambs		
	Lot 1 Rape	Lot 2 Rape and corn (½ feed)	Lot 3 Rape and corn (full feed)	Lot 4 Rape	Lot 5 Rape and corn (½ feed)	Lot 6 Rape and corn (full feed)
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
July 12 to August 8*	.....	.170	.188	.....	.170	.188
August 9 to September 5	.....	.210	.402	.....	.210	.402
September 6 to October 2†	.....	.370	.740	.....	.389	.778
Av. for entire experiment	.....	.238	.424	.....	.269	.496
Total corn consumed	11.00‡	151.75	270.75	11.00‡	210.25	387.75

*Corn fed only during the last 16 days of this period.
†Includes only September 6 to 19, inclusive, for Lots 1, 2 and 3.
‡Lots 1 and 4 were fed a small amount of corn the first week after weaning

Because of the Shropshire lambs being larger than the cross-breds, they consumed the rape in their plots in about 2 weeks less time. By September 19, Lot 1 had eaten all the rape in the plot assigned to it, and Lots 1, 2 and 3 were dropped out of the experiment, although Lot 2, fed one-half feed of corn, had a small amount of rape left, and Lot 3, fed a full feed of corn, had still more rape remaining. By October 2, Lot 4 had eaten all the rape in the plot allotted to it, while a small amount remained in the plots allotted to Lots 5 and 6.

Water, salt, etc.—Water was kept before the lambs at all times in wooden tubs. The lambs also had access to salt at all times. The lambs were given the blue vitriol treatment for internal parasites on August 14. They were kept on the plots at all times except when they were driven to the barn to be weighed or treated for parasites. Wooden shades were provided to afford protection from the sun.

WEIGHTS AND GAINS

The initial and final weights were secured by averaging three weights taken on successive days, except that the final weights of the lambs in Lots 4, 5 and 6 were secured by averaging two weights taken on successive days. The lambs were weighed every 2 weeks during the progress of the experiment. Weights were taken soon after noon after the lambs had received their usual feed and water. Table XXII shows the loss in weight by the ewes during the 12 days they were on the experiment, the gain made by each lot of lambs up to September 19, and the gain made by the lambs in Lots 4, 5 and 6 up to October 2.

TABLE XXII, EXPERIMENT IV.—WEIGHTS AND GAINS

Ten ewes and eleven lambs in each lot

Loss by ewes, 12 days, July 12 to 23, inclusive

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Initial weight, July 10-11-12..	1027.5	1024.5	1066.	831.	818 5	831
Final weight, July 24.....	1019.	994.5	1047.5	767.	786 5	828.
Loss	—8.5	—30.	—18.5	—64.	—32.5	—3.

Gains made by lambs; 70 days, July 12 to September 19, inclusive

	Shropshire lambs			Shropshire x Merino lambs		
	Lot 1 Rape	Lot 2 Rape and corn (½ feed)	Lot 3 Rape and corn (full feed)	Lot 4 Rape	Lot 5 Rape and corn (½ feed)	Lot 6 Rape and corn (full feed)
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Initial weight, July 10-11-12..	515.5	516.	518.	455.5	454.5	457.5
Final weight, Sept. 18-19-20.	732.	802.5	823.5	711.5	712.5	725.
Total gain..... ..	216.5	286.5	305.5	256.	258.	267.5
Average daily gain per head	.281	.372	.397	.332	.335	.347

Gains made by Shropshire x Merino lambs; 83 days, July 12 to October 2, inclusive

	Lot 4	Lot 5	Lot 6
	Lbs.	*Lbs.*	*Lbs.*
Initial weight, July 10, 11 and 12.....	455.5	454.5	457.5
Final weight, October 2 and 3.....	743.5	758.5	770.
Total gain.....	288.	304.	312.5
Average daily gain per head.....	.315	.333	.342

Table XXII shows that the ewes in all lots lost in weight during the 12 days they were in the experiment. It is quite probable that the loss in weight was largely a difference in "fill" caused by the sudden and radical change in pasture.

Table XXII shows that the Shropshire lambs fed one-half feed of corn gained 32.3 percent more than those fed no corn (compare Lots 1 and 2) and that the lambs fed a full feed of corn gained 6.6

percent more than those fed one-half feed (compare Lots 2 and 3). In case of the crossbred lambs the increased gain from feeding one-half feed of corn was only 5.6 percent (compare Lots 4 and 5) while the lambs fed a full feed of corn gained only 2.8 percent more than those fed one-half feed (compare Lots 5 and 6). This table also shows that the total amount of gain produced by the crossbred lambs was greater than that produced by the corresponding lots of Shropshire lambs (compare Lots 1, 2 and 3 with Lots 4, 5 and 6, respectively,) but because of the longer time taken to produce these gains, the average daily gain per head was greater for the Shropshire lambs, with the exception of Lots 1 and 4 where no grain was fed.

Table XXIII presents some data which have no direct bearing on this experiment but which are of interest in comparing the Shropshire and Shropshire x Merino lambs from birth until the experiment began.

TABLE XXIII, EXPERIMENT IV.—COMPARISON OF SHROPSHIRE AND SHROPSHIRE X MERINO LAMBS WITH RESPECT TO WEIGHT AT DIFFERENT AGES, AND RATE OF GAIN

	Shropshires	Shropshire x Merinos
Average weight at birth.....Pounds..	10.12	8.10
Average weight at 10 days of age.....Pounds .	14.48	12.55
Average weight at beginning of experiment.....Pounds..	46.95	41.45
Average age at beginning of experiment.....Days..	111.58	97.60
Average daily gain to beginning of experiment[a].....Pound	.330	.342

[a] Does not include weight at birth.

Table XXIII shows that the Shropshire lambs weighed about 2 pounds more at birth and at 10 days of age than did the crossbreds. The crossbred lambs made a slightly greater average daily from birth to the time the experiment began.

COST OF GAINS

The cost of the feed per 100 pounds of gain made by each lot with feeds at four different combinations of prices is shown in Table XXIV. This table shows that all the lots, even with the highest prices for feeds shown in the table, made exceptionally cheap gains, particularly when compared with the price received for the lambs (see p. 97). These cheap gains may be attributed to a combination of good feeds and vigorous, thrifty lambs.

In calculating this table the value of the loss by the ewes was not taken into consideration. While this may not be quite fair from the standpoint of determining the exact value of the gains produced,

it makes possible a more nearly accurate comparison of the cost of the gains produced by the different lots. The value of the loss by the ewes was not large enough to add greatly to the cost of gains made by the lambs, but the variation in the amount of loss by the ewes in different lots was sufficient to affect the relative standing of the lots with respect to cost of gains. Since it is highly improbable that the difference in the breed or treatment of the lambs had any influence on the loss in weight by the ewes, it does not seem that this factor should be taken into consideration in comparing the cost of the gains made by the different lots of lambs.

XXIV, EXPERIMENT IV.—COST OF FEED PER 100 POUNDS OF GAIN

Feed price combination*	Shropshires			Shropshire x Merinos		
	Lot 1 Rape	Lot 2 Rape and corn (½ feed)	Lot 3 Rape and corn (full feed)	Lot 4 Rape	Lot 5 Rape and corn (½ feed)	Lot 6 Rape and corn (full feed)
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollar*
1	2.36	2.27	2.52	1.77	2.34	2.84
2	3.54	3.45	3.78	2.66	3.50	4.26
3	4.72	4.55	5.04	3.55	4.67	5.68
4	7.08	6.82	7.57	5.32	7.01	8.52

*Feed price combinations are as follows:

Price combination	Corn, per bu.	Rape, per acre
1	$ .56	$10
2	.84	15
3	1.12	20
4	1.68	30

Table XXIV shows no great or consistent differences between the Shropshire and the crossbred lambs with respect to cost of feed per 100 pounds of gain. In case of the Shropshire lambs, this table shows that feeding one-half feed of corn lowered the cost of gains, but when a full feed was given the cost of the gains was greater than when no corn was fed. In case of the crossbred lambs, feeding one-half feed of corn increased the cost of gains, and the cost was further increased when a full feed of corn was given.

A much better basis for determining the economy of feeding corn to lambs on rape pasture is furnished by Table XXV, which shows the amount of additional gain produced by feeding one-half feed and a full feed of corn, the amount of corn fed, the additional home value of the corn-fed lambs, and the net cost of the corn consumed for each 100 pounds of additional gain, after making allowance for the greater value of the corn-fed lambs. A probable source of a slight error in Table XXV is the fact that in computing this table it was impossible to take into account the difference in the amount of green feed that was eaten by the various lots.

TABLE XXV, EXPERIMENT IV.—NET COST OF CORN CONSUMED PER 100 POUNDS OF ADDITIONAL GAIN RESULTING FROM FEEDING CORN

	Shropshires		Shropshire x Merinos	
	Lot 2 One-half feed corn	Lot 3 Full feed corn	Lot 5 One-half feed corn	Lot 6 Full feed corn
Additional gain due to feeding corn.....Pounds..	70.	89.	16.	24.5
Corn consumed*.....Pounds..	140.75	259.75	199.25	376.75
Additional home value, per 100 lbs., of corn-fed lambs†.....Dollars..	.41	.27	.23	.56
Additional home value, per lot, of corn-fed lambs‡.....Dollars..	3.29	2.22	1.75	4.30
Net cost of corn consumed per 100 lbs. additional gain:§				
Corn at $ .56 per bushel.....Dollars..	.....	.42	1.52	.....
Corn at $1.12 per bushel.....Dollars..	.....	3.34	13.97	13.20
Corn at $1.68 per bushel.....Dollars..	1.33	6.26	26.42	28.58

*Shows the amount of corn consumed in excess of the small amount consumed by Lots 1 and 4 (see Table XXI).

†See text on p. 96 for explanation of difference in home values of different lots.

‡This item represents the increase in value of the initial weight of the lambs and the additional value of the gain which resulted from feeding corn. In making this calculation the same initial weight was assumed for all three lots in Merinos and for all three lots of Shropshire x Merinos; otherwise the lots having the greatest initial weight would have an unfair advantage.

§Where no figures are shown, the increased value of the corn-fed lambs was more than enough to pay for the corn consumed.

Table XXV shows that in case of the Shropshire lambs fed one-half feed of corn, the increased value of the corn-fed lambs was more than enough to pay for the corn fed, with corn valued as high as $1.12 per bushel, and with corn valued at $1.68 per bushel the net cost of the corn consumed per 100 pounds of additional gain was only $1.33. When a full feed of corn was given, the net cost of the additional gain was somewhat higher than when only one-half feed of corn was given, but the cost was considerably lower than the prices for lambs which are likely to accompany the respective prices for corn. Since the crossbred lambs did not respond as well to feeding corn, the cost of the additional gains was higher. Table XXV indicates that corn could have been fed at a profit to the crossbred lambs with corn valued at $0.56 per bushel, but with corn at a price much higher than $1.12 per bushel, the feeding of corn would have been doubtful economy.

Tables XXII and XXV indicate that in this experiment the Shropshire lambs made better use of the corn than did the crossbreds, or that the crossbreds were better able than were the Shropshire to make good gains on rape alone. There is not sufficient justification to assume, however, that this is generally true. Work is in progress which should yield more data on this point.

GAIN PRODUCED FROM AN ACRE OF RAPE

Table XXVI shows the loss in weight by the ewes, the gains made by the lambs and the value of the gains, per acre, for each lot with lambs valued at $10 and $15 per 100 pounds. The value of the loss in weight by the ewes, at 6 cents per pound, was deducted from the value of the gains made by the lambs. The value of the corn fed to Lots 2, 3, 5 and 6, at $1.12 per bushel, was deducted from the value of the gains produced by the lambs in these lots. Because of the impossibility of separating the profit (or loss) from feeding corn from the value of the returns from pasture, Lots 1 and 4, to which no corn was fed, are the only lots which show the exact value of the returns per acre of pasture. These data show the return which may be secured from pasturing lambs on rape under favorable conditions. Table XXVI shows that the crossbred lambs (Lot 4) produced 143 pounds more gain per acre than did the Shropshire lambs (Lot 1). The data are not sufficiently extensive, however, to establish the fact that crossbred lambs are more profitable than are purebred or high-grade lambs. Further work along this line is in progress.

TABLE XXVI, EXPERIMENT IV.—GAIN PER ACRE OF RAPE

	Shropshires			Shropshire x erinos		
	Lot 1 Rape	Lot 2 Rape and corn (½ feed)	Lot 3 Rape and corn (full feed)	Lot 4 Rape	Lot 5 Rape and corn (½ feed)	Lot 6 Rape and corn (full feed)
Ewes on pasture.....Number..	10	10	10	10	10	10
Lambs on pasture.....Number..	11	11	11	11	11	11
Area of pasture.....Acre..	.5	.5	.5	.5	.5	.5
Loss, per acre, on ewes.....Pounds..	17	60	37	128	65	6
Gain, per acre, on lambs....Pounds..	433.	573.	611.	576	608	625
Av. daily gain per lamb.....Pound..	.281	.372	.397	.315	.333	.342
Value of gain on lambs, per acre:						
Lambs at $10 per 100 lbs.Dollars..	42.28	47.63	48.05	49.82	48.39	46.63
Lambs at $15 per 100 lbs.Dollars..	63.93	76.28	78.60	78.72	78.89	77.88

MARKET FINISH AND PRICE, COST OF MARKETING AND HOME VALUES

By the time the experiment closed the lambs were well finished and but little difference could be noticed in the finish carried by the different lots. Lots 1 and 4 appeared to carry slightly less flesh than the other lots, although this was not indicated by a subsequent slaughter test (see Table XXVIII). All lots were sold at the same price, $17.25 per 100 pounds. The difference in the home values of the different lots is due to the difference in shrinkage in shipping (see Table XXVIII).

At the close of the experiment the wether lambs were shipped direct to a packing firm in Cleveland, Ohio, so there were no charges for yardage or commission. The freight on the car load of 2,400 pounds, Cleveland weights, amounted to $13.61, or $0.567 per 100 pounds. Table XXVII shows the Cleveland price for each lot, the cost of marketing and the home value after allowing for the cost of marketing and the shrink in shipping. Because of the abnormally heavy shrink in shipping (see Table XXVIII) and because they were marketed in a comparatively small lot which resulted in a relatively high cost per 100 pounds, there was a greater spread between home and market prices than should exist.

TABLE XXVII, EXPERIMENT IV.—MARKET AND HOME PRICES AND COST OF MARKETING

	Shropshires			Shropshire x Merinos		
	Lot 1 Rape	Lot 2 Rape and corn (½ feed)	Lot 3 Rape and corn (full feed)	Lot 4 Rape	Lot 5 Rape and corn (½ feed)	Lot 6 Rape and corn (full feed)
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Cleveland prices, per 100 lbs..	17.25	17.25	17.25	17.25	17.25	17.25
Cost of marketing, per lot.....	2.13	1.90	2.03	2.10	2.48	2.51
Home value, per 100 lbs.....	14.07	14.48	14.34	14.23	14.46	14.79

SHRINK IN SHIPPING AND SLAUGHTER TEST

The wether lambs were loaded on the car at Wooster about noon on October 3. Owing to congested traffic conditions they did not arrive in Cleveland until about noon, October 5. The lambs were fed and watered enroute but on arrival at Cleveland they were weighed and killed without being given either feed or water. This accounts for the abnormally heavy shrink in shipping, shown in Table XXVIII, and made the yield of dressed carcass greater than it would have been had the lambs not experienced such a heavy shrink.

Table XXVIII shows that the lambs that were fed grain shrank less in shipping than did the lots that were not fed grain. The Shropshire lambs shrank more than did the Shropshire x Merino lambs.

As may be seen from Table XXVIII, the proportion of dressed carcass to live weight was very similar in all lots.

TABLE XXVIII, EXPERIMENT IV.—SLAUGHTER TEST AND SHRINK IN SHIPPING

	Shropshires			Shropshire x Merinos		
	Lot 1 Rape	Lot 2 Rape and corn (½ feed)	Lot 3 Rape and corn (full feed)	Lot 4 Rape	Lot 5 Rape and corn (½ feed)	Lot 6 Rape and corn (full feed)
Lambs shipped..... Number	6	5	5	6	7	7
Home weight, Oct. 3..... Pounds	446*	386.	416.5	435.	498.5	498.5
Cleveland weight, Oct. 5.... Pounds	376*	335.	358.	371.	438.	442.
Shrink in shipping..... Percent	15*70	13.21	14 05	14.71	12.14	11.33
Yield of dressed carcass†... Percent..	52*93	52.09	52.51	52.96	53 31	51 7

*Weighed before feed or water were given.
†The yield is based on warm weight of carcasses, dressed with back sets and caul fat on.

CONCLUSIONS FROM EXPERIMENT IV

THE ECONOMY OF FEEDING CORN ON RAPE PASTURE

Rate of gain.—During the same length of time and on the same area of rape pasture, Shropshire lambs fed one-half feed of corn gained 32.3 percent more, and those fed a full feed of corn gained 41.1 percent more than lambs that were not fed corn. Shropshire x Merino lambs fed one-half feed of corn gained 5.6 percent more, and those fed a full feed of corn gained 8.5 percent more than lambs that were not fed corn. (See Table XXII, p. 92.)

Cost of gains.—Table XXIV, p. 94, shows that even with high-priced feeds all lots of lambs made cheap gains. Table XXV shows that in case of the Shropshire lambs, corn could have been fed at a profit with corn valued as high as $1.68 per bushel. In case of the crossbred lambs, it is doubtful if corn could have been profitably fed with corn worth much more than $1.12 per bushel.

Gain from an acre of rape pasture.—Tables XXII and XXVI, pp. 92 and 96, show that in Lot 1, one-half acre of rape pasture carried 10 Shropshire ewes for 12 days and 11 Shropshire lambs for 70 days and produced 216.5 pounds of gain on the lambs, or at the rate of 433 pounds of gain per acre. In Lot 4, one-half acre of rape carried 10 Merino ewes for 12 days and eleven Shropshire x Merino lambs for 83 days, and produced 288 pounds of gain on the lambs, or at the rate of 576 pounds of gain per acre.

Market finish and price.—The lambs fed corn in addition to rape appeared to carry a slightly better finish at the close of the experiment than did those that were fed on rape alone, but the yield of dressed carcass when the lambs were slaughtered did not indicate that this was true. (See Table XXVIII, p. 98.) All lots sold for the same price per 100 pounds,

Shrink in shipping and yield of dressed carcass.—The lambs that were fed no corn on pasture shrank more in shipping than the lambs that were fed one-half feed and a full feed of corn, as is shown by Table XXVIII. This same table shows that there appeared to be no relation between the amount of corn fed and the yield of dressed carcass.

This experiment as well as the experiments previously reported in this bulletin, indicates that while low-priced corn may be profitably fed to lambs on pasture, corn is not necessary for the economical production of high-class lambs, if an abundance of good pasture is provided.

COMPARISON OF SHROPSHIRE AND SHROPSHIRE x MERINO LAMBS

Rate of gain.—The crossbred lambs made larger total gains per acre of rape than did the Shropshires, although with the exception of the lots which were not fed corn, the Shropshire lambs made slightly larger gains during the same period of time. (See Table XXII, p. 92).

Cost of gains.—Table XXIV, p. 94, shows that when the lambs were fed on rape alone, the crossbred lambs made the cheaper gains, but when corn was fed in addition to rape, the Shropshire made slightly cheaper gains.

Gains from an acre of rape.—Table XXVI shows that all three lots of crossbred lambs made larger gains from an acre of rape than did the corresponding lots of Shropshire lambs. The crossbred lambs required 13 days longer than did the Shropshires to consume the rape from half-acre plots.

Market finish and price.—There was no noticeable difference in the finish carried by correspondingly fed lots of Shropshire and Shropshire x Merino lambs, and all lots sold for the same price per 100 pounds. (See Table XXVII, p. 97.)

Shrink in shipping and yield of dressed carcass.—The crossbred lambs shrank slightly less in shipping than did the Shropshires. (See Table XXVIII, p. 98.)

Table XXVIII shows no consistent difference between the Shropshire and the crossbred lambs with respect to yield of dressed carcass.

The Shropshire x Merino lambs used in Experiment IV were superior to Shropshire lambs from the standpoint of rate and economy of gain and the amount of gain produced from an acre of rape. Further data are needed before any such superiority for the crossbred lambs can be established.